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Improving Care for Acute and Chronic Problems with Smart Forms and Quality Dashboards

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Partners HealthCare System, Inc.

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Harvard Medical School

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Partners HealthCare System

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Agenda

- Brief Introduction to Partners IS
- Motivation for Smart Forms and Quality Dashboards
  - LMR, Patient Gateway
  - The Signature Initiatives -> High Performance Medicine
  - Partners Advanced Informatics Infrastructure
- SFQD Study Design
  - Preliminary Focus Group and Survey Data
- Architecture and Software Overview
  - Smart Forms
  - Quality Dashboards
- Discussion

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Partners HealthCare – NHII *in situ*

- Founded in 1994
  - Brigham and Women's Hospital
  - Massachusetts General Hospital
- Now includes:
  - Community Physician Network
  - 2 Rehab Hospitals
  - 4 Community Hospitals
  - Affiliated cancer hospital – Dana Farber
- Common Clinical IT supported by Partners Information Systems

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Overview of Partners IS: Scale of the Integration Effort

- 55,000 devices attached to the Partners network
- 45,000 users accounts
- 110 locations on the network
- 750 servers
- 800 applications
- 540 active projects
- 1,100 employees based in 19 locations

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What Are the Signature Initiatives?

The Signature Initiatives are five System-wide projects with one common goal:

To deliver better care to patients.

- **Care that is:**
  - **Safer**
  - **Better coordinated**
  - **More reliable in delivering proven interventions**
- **Systems that support providers in "doing the right thing."**

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What Are the Signature Initiatives?

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Infrastructure

1. Investing in quality and utilization infrastructure
   - —Information systems
   - —Other resources

Initiative Focus

Quality

Efficiency

2. Enhancing patient safety by reducing medication errors system-wide
3. Enhancing uniform high quality by measuring performance to benchmark for select inpatient and outpatient conditions
4. Expanding disease management programs by supporting activities for certain patients with chronic illnesses
5. Improving cost effectiveness through managing utilization trends and analysis of variance

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Business Goals Drive IT Objectives

- Business Goals
  - Enhancing patient safety by reducing medication errors
  - Enhancing uniform high quality by measuring performance
  - Expanding disease management programs
  - Improving cost effectiveness through managing utilization trends
  - Improving patient care access and convenience
- IT Objectives
  - Support key business initiatives through the design and implementation of improved IT infrastructure
    - Bridge system silos to make information available everywhere
    - Achieve enterprise wide interoperability of key data types to support decision support and data aggregation
    - Manage knowledge to achieve uniform best practices
    - Make results visible to drive process improvement

Increasing Enterprise Integration: Progressive Homogeneity via SOA

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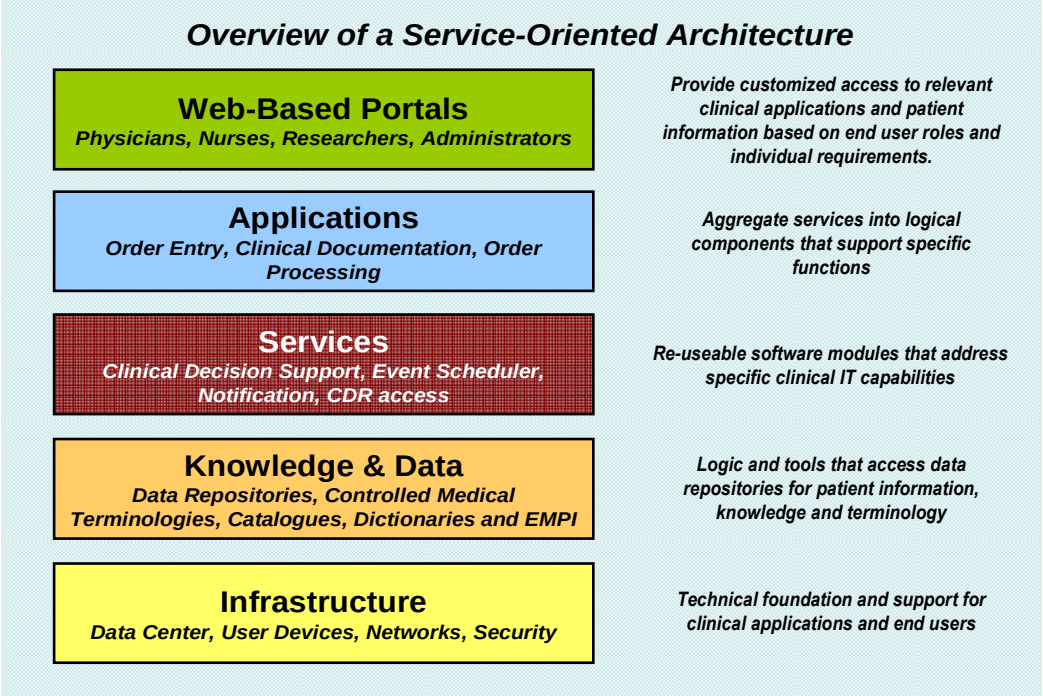
Increasing the level of enterprise integration is supported by core IT services that can be integrated with and/or accessed by site-based applications.

These IT services integrate and communicate with the site-based and enterprise applications via a ***service-oriented architecture*** made up of layered components.

This approach leverages:

- A common technology infrastructure;
- Common data, terminology and rules (especially those associated with allergies, problems and medications);
- Shared clinical services and applications; and
- Customized views and capabilities for specific user types.



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Discrete vs. Shared Data, Knowledge, Logic

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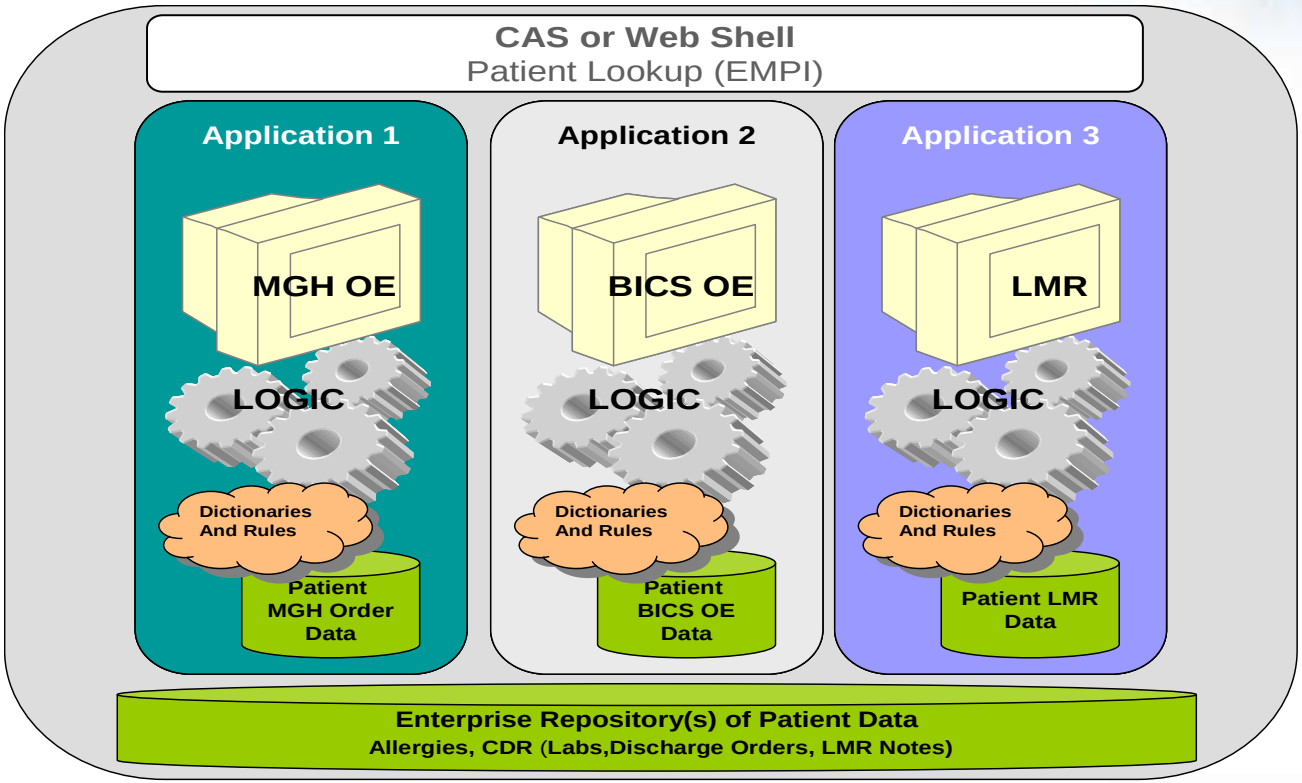
Many Partners' applications utilize discrete data, logic and knowledge or rules; most are not integrated across sites – creating islands of information and supporting varying levels of functionality.



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The Future: Shared Data, Knowledge, and Logic

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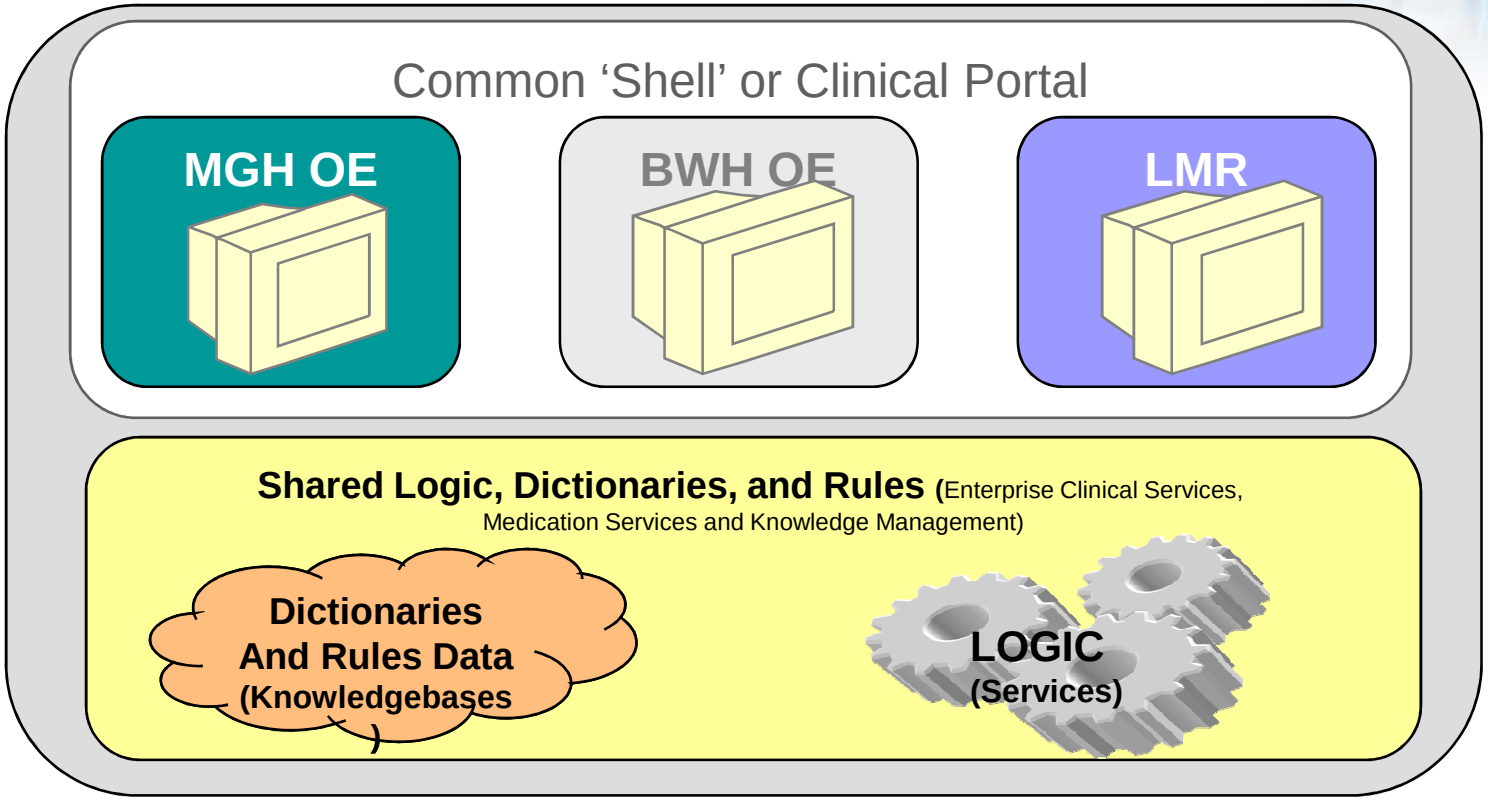
Future clinical applications will take advantage of shared repositories of enterprise data, knowledge, and logic, in a *services-oriented architecture*



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Knowledge Management Portal

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Keyword Search: Search

Home | Browse by Topic | Filter-based Search

Welcome to the KM portal!

- Welcome
- About Us
- Overview
- Launching KM Portal
- Help
- FAQ
- Glossary

Download a Quick Reference guide in Word format

Announcements

We've changed!

With usability in mind, we recently under went a resign of our Knowledge Management portal. Alan Rose, usability expert in CIRD, has completed interface redesign for other Partners applications such as Patient Gateway and LMR to name a few. The Knowledge Management portal is almost a year old and we thought it would be the right time to implement usability improvements and provide our users with easier to use search interfaces.

What has changed? First, we upgraded our code to a .NET platform through the hard work of **Web Integration Team** and **PHS Web Development**. Second, we've improved our graphical interface and site layout, and we've added bread crumbs for improved taxonomy navigation. With filter based search, you will find your can refine your search within the same screen without having to use the back button. With keyword search, navigation between pages of search results is easier to use. These are just a few of the improvements you will find.

If you are visiting the site for the first time, please visit our getting started guide which provides and overview of search capability and functions. You can also review the Glossary of terms to familiarize yourself with our site's terms and terminology.

If you have feedback related to the site's redesign, please email Cathyann Harris at charris7@partners.org who is coordinating the development, deployment efforts for this site.

This site is intended to help anyone at Partners who is engaged in embedding clinical knowledge into the various electronic health record systems share that knowledge with each other. Partners has a rich inventory of order sets, rules, reminders, expert dosing databases, drug information, and documentation templates embedded in a rich array of clinical systems. The Partners Knowledge Management Team has begun the process to inventory and catalogue these assets to support sharing and efficient maintenance.

You can access these assets in three ways:

Keyword Search | Browse by Topic | Filter-based Search

Site navigation is organized by the four key domains of the Partners Signature Initiatives: Quality, Safety, Disease Management, and Trend Management .

Filter-based search makes it possible to look at content comparatively. For example, if one would like to compare order sets for cardiac interventions at the Brigham and Women's Hospital and the Massachusetts General Hospital, then filter-based search is the simplest way to view information sifted for these attributes.

Alternatively, if one wants to see all the content related to managing anticoagulation, then navigating there from the Safety section of site navigation will be the simplest. For more information on this please go to "Getting Started". Our team will continue to catalogue and update in the upcoming years, particularly as more hospitals implement physician order entry systems and the LMR.

In addition, in 2005, we'll begin implementing specialized tools to support better collaboration with subject matter experts in content development as well as more efficient management of the tracking, versioning, and cataloguing needed for content management. We look forward to working with all of you to make this portal work for you.

If you are looking for content and cannot find it, or if your are having technical difficulty with the site, please contact the Help Desk at **617-732-5927** and open at ticket under the **KNOWLEDGE MANAGEMENT** queue, we'll be glad to help. Our hours of primary support are **8:30-4:30 Mon- Friday**.

Compare Content Across Organizations

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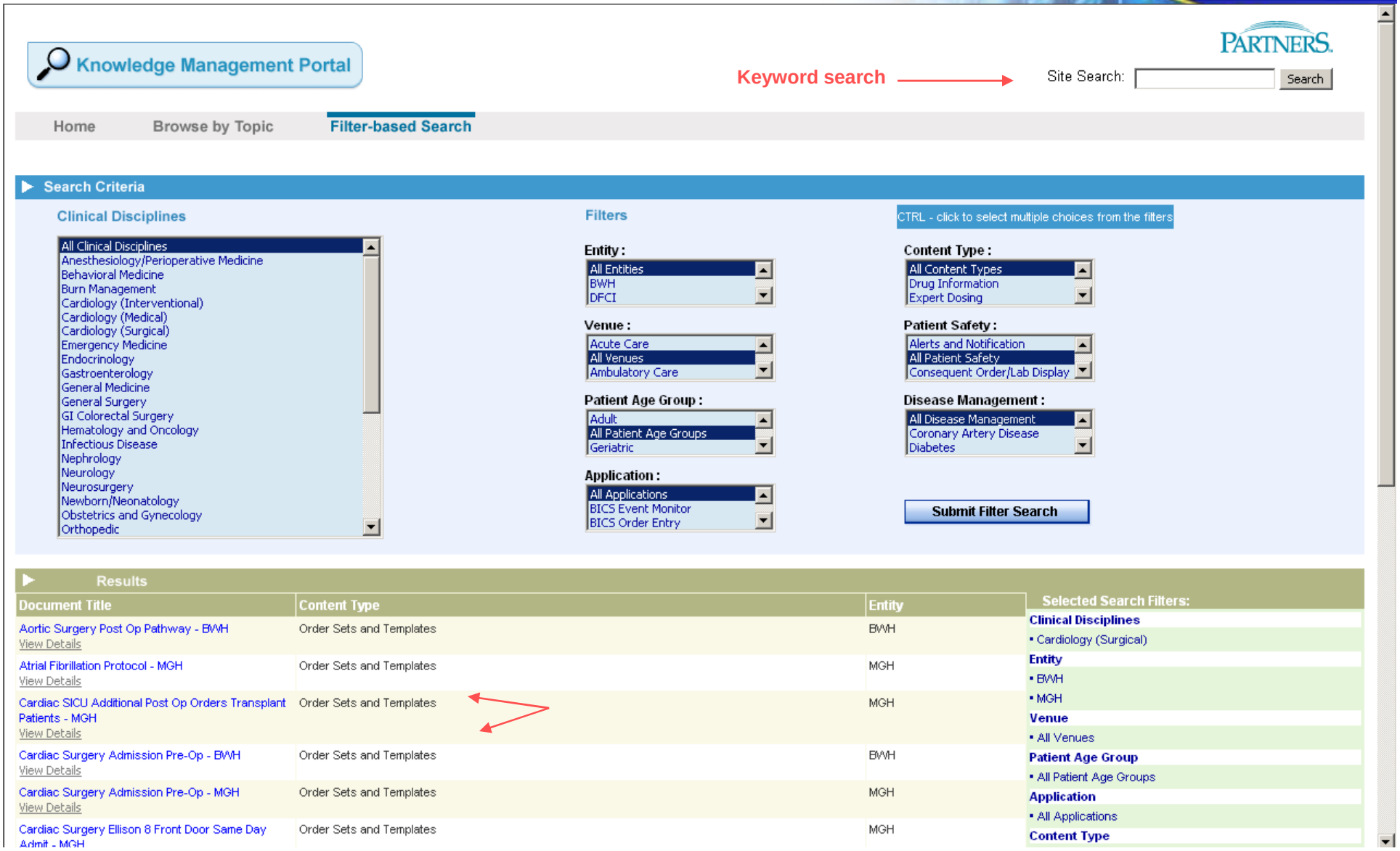

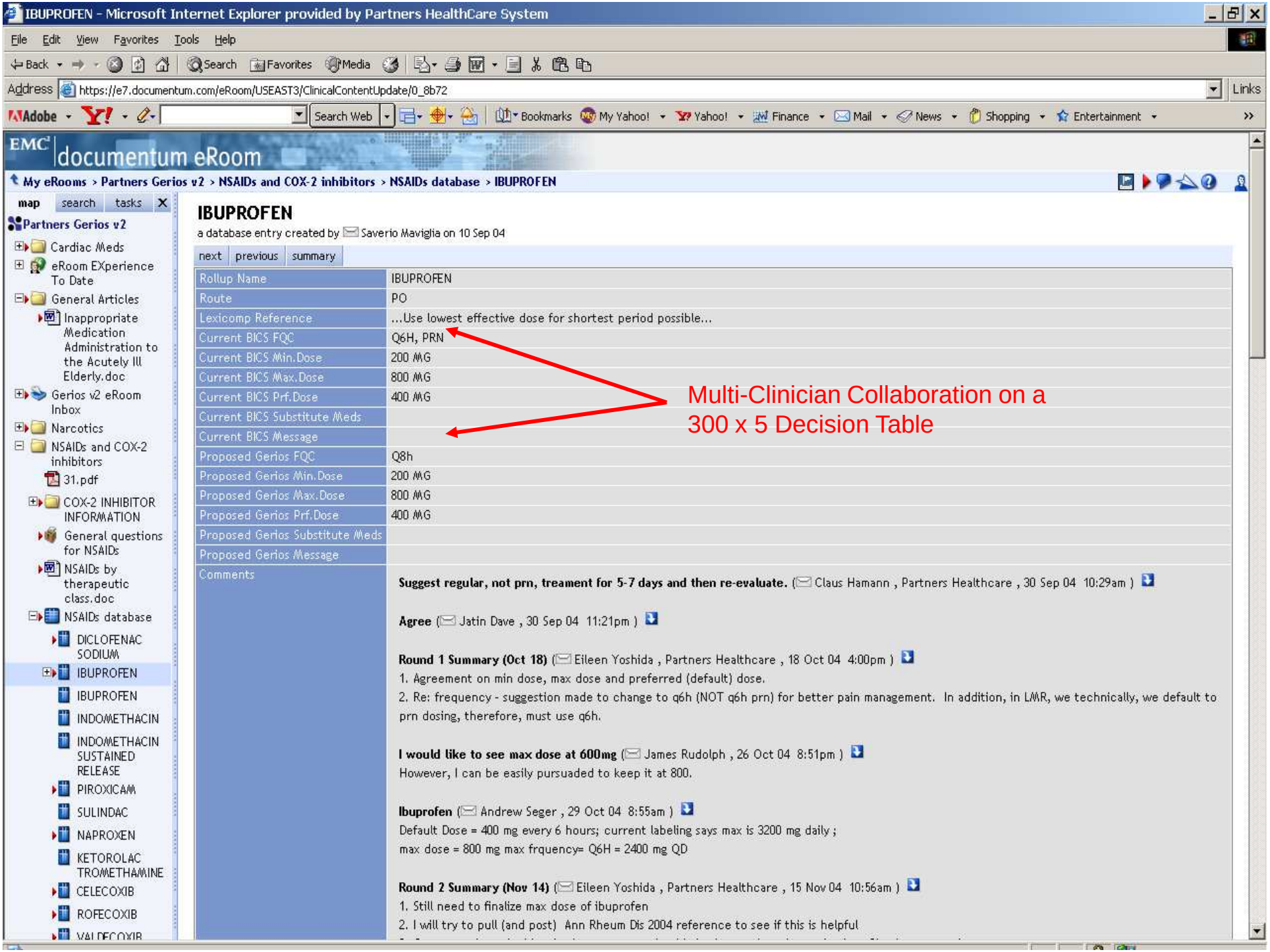
IBUPROFEN - Microsoft Internet Explorer provided by Partners HealthCare System
File Edit View Favorites Tools Help
Back Search Favorites Media
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Links
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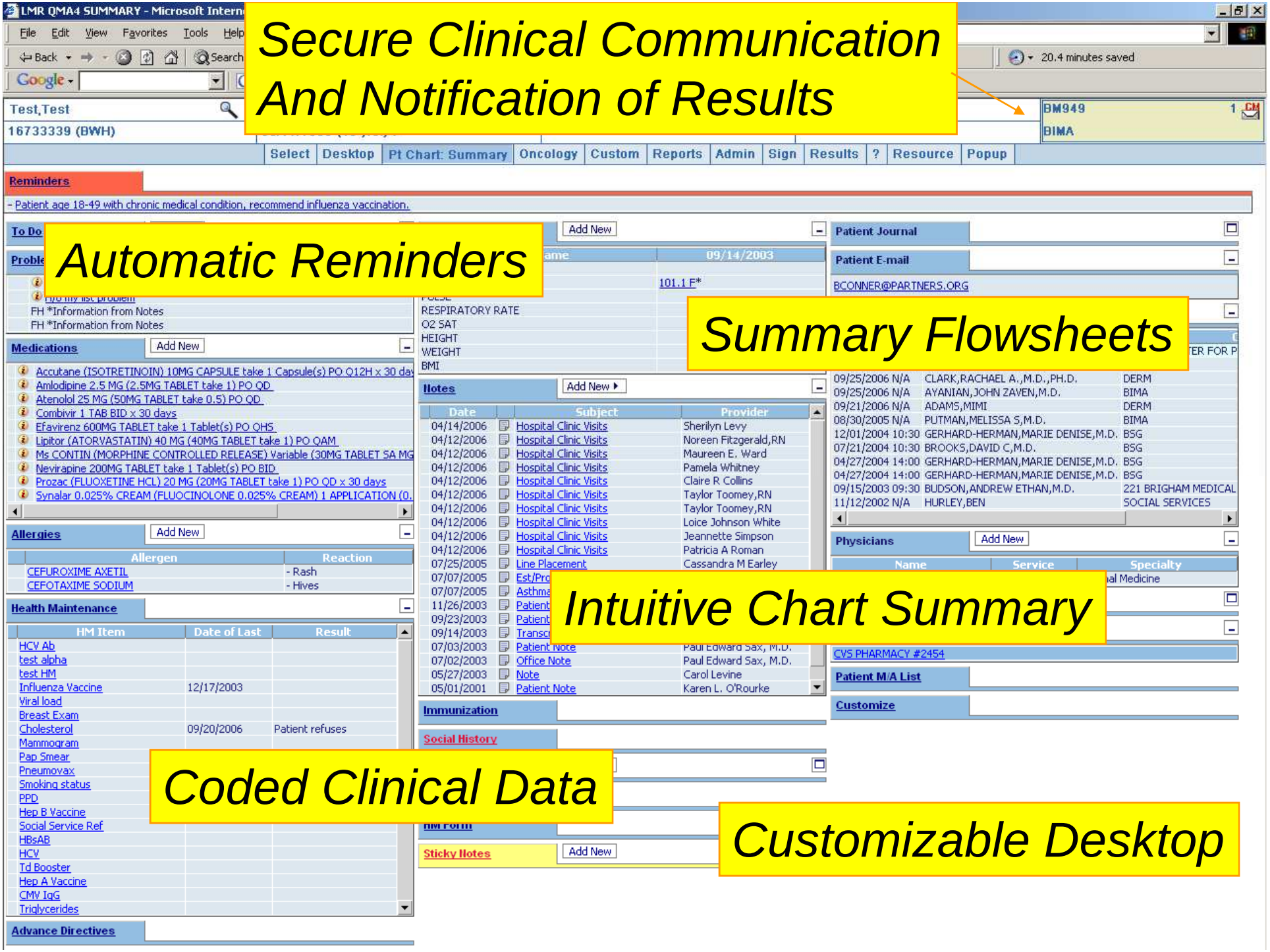
EMC documentum eRoom
My eRooms > Partners Gerios v2 > NSAIDs and COX-2 inhibitors > NSAIDs database > IBUPROFEN
map search tasks
Partners Gerios v2
Cardiac Meds
eRoom EXperience To Date
General Articles
Inappropriate Medication Administration to the Acutely Ill Elderly.doc
Gerios v2 eRoom Inbox
Narcotics
NSAIDs and COX-2 inhibitors
31.pdf
COX-2 INHIBITOR INFORMATION
General questions for NSAIDs
NSAIDs by therapeutic class.doc
NSAIDs database
DICLOFENAC SODIUM
IBUPROFEN
IBUPROFEN
INDOMETHACIN
INDOMETHACIN SUSTAINED RELEASE
PIROXICAM
SULINDAC
NAPROXEN
KETOROLAC TROMETHAMINE
CELECOXIB
ROFECOXIB
VALDECOXIB
IBUPROFEN
a database entry created by Saverio Maviglia on 10 Sep 04
next previous summary
Rollup Name IBUPROFEN
Route PO
Lexicomp Reference ...Use lowest effective dose for shortest period possible...
Current BICS FQC Q6H, PRN
Current BICS Min.Dose 200 MG
Current BICS Max.Dose 800 MG
Current BICS Prf.Dose 400 MG
Current BICS Substitute Meds
Current BICS Message
Proposed Gerios FQC Q8h
Proposed Gerios Min.Dose 200 MG
Proposed Gerios Max.Dose 800 MG
Proposed Gerios Prf.Dose 400 MG
Proposed Gerios Substitute Meds
Proposed Gerios Message
Comments
Suggest regular, not prn, treament for 5-7 days and then re-evaluate. (Claus Hamann , Partners Healthcare , 30 Sep 04 10:29am)
Agree (Jatin Dave , 30 Sep 04 11:21pm)
Round 1 Summary (Oct 18) (Eileen Yoshida , Partners Healthcare , 18 Oct 04 4:00pm)
1. Agreement on min dose, max dose and preferred (default) dose.
2. Re: frequency - suggestion made to change to q6h (NOT q6h prn) for better pain management. In addition, in LMR, we technically, we default to prn dosing, therefore, must use q6h.
I would like to see max dose at 600mg (James Rudolph , 26 Oct 04 8:51pm)
However, I can be easily pursuaded to keep it at 800.
Ibuprofen (Andrew Seger , 29 Oct 04 8:55am)
Default Dose = 400 mg every 6 hours; current labeling says max is 3200 mg daily ;
max dose = 800 mg max frquency= Q6H = 2400 mg QD
Round 2 Summary (Nov 14) (Eileen Yoshida , Partners Healthcare , 15 Nov 04 10:56am)
1. Still need to finalize max dose of ibuprofen
2. I will try to pull (and post) Ann Rheum Dis 2004 reference to see if this is helpful
Multi-Clinician Collaboration on a
300 x 5 Decision Table


Secure Clinical Communication
And Notification of Results
Automatic Reminders
Summary Flowsheets
Intuitive Chart Summary
Coded Clinical Data
Customizable Desktop
LMR QMA4 SUMMARY - Microsoft Intern
File Edit View Favorites Tools Help
20.4 minutes saved
Test,Test
16733339 (BWH)
BM949
BIMA
Select Desktop Pt Chart: Summary Oncology Custom Reports Admin Sign Results ? Resource Popup
Reminders
- Patient age 18-49 with chronic medical condition, recommend influenza vaccination.
To Do
Add New
Patient Journal
Patient E-mail
BCONNER@PARTNERS.ORG
09/14/2003
101.1 F*
RESPIRATORY RATE
O2 SAT
HEIGHT
WEIGHT
BMI
FH *Information from Notes
FH *Information from Notes
Medications
Add New
Accutane (ISOTRETINOIN) 10MG CAPSULE take 1 Capsule(s) PO Q12H x 30 day
Amlodipine 2.5 MG (2.5MG TABLET take 1) PO QD
Atenolol 25 MG (50MG TABLET take 0.5) PO QD
Combivir 1 TAB BID x 30 days
Efavirenz 600MG TABLET take 1 Tablet(s) PO QHS
Lipitor (ATORVASTATIN) 40 MG (40MG TABLET take 1) PO QAM
Ms CONTIN (MORPHINE CONTROLLED RELEASE) Variable (30MG TABLET SA MG
Nevirapine 200MG TABLET take 1 Tablet(s) PO BID
Prozac (FLUOXETINE HCL) 20 MG (20MG TABLET take 1) PO QD x 30 days
Synalar 0.025% CREAM (FLUOCINOLONE 0.025% CREAM) 1 APPLICATION (0.
Notes
Add New
Date Subject Provider
04/14/2006 Hospital Clinic Visits Sherilyn Levy
04/12/2006 Hospital Clinic Visits Noreen Fitzgerald,RN
04/12/2006 Hospital Clinic Visits Maureen E. Ward
04/12/2006 Hospital Clinic Visits Pamela Whitney
04/12/2006 Hospital Clinic Visits Claire R Collins
04/12/2006 Hospital Clinic Visits Taylor Toomey,RN
04/12/2006 Hospital Clinic Visits Taylor Toomey,RN
04/12/2006 Hospital Clinic Visits Loice Johnson White
04/12/2006 Hospital Clinic Visits Jeannette Simpson
04/12/2006 Hospital Clinic Visits Patricia A Roman
07/25/2005 Line Placement Cassandra M Earley
07/07/2005 Est/Pro
07/07/2005 Asthma
11/26/2003 Patient
09/23/2003 Patient
09/14/2003 Transcr
07/03/2003 Patient Note Paul Edward Sax, M.D.
07/02/2003 Office Note Paul Edward Sax, M.D.
05/27/2003 Note Carol Levine
05/01/2001 Patient Note Karen L. O'Rourke
09/25/2006 N/A CLARK,RACHAEL A.,M.D.,PH.D. DERM
09/25/2006 N/A AYANIAN,JOHN ZAVEN,M.D. BIMA
09/21/2006 N/A ADAMS,MIMI DERM
08/30/2005 N/A PUTMAN,MELISSA S,M.D. BIMA
12/01/2004 10:30 GERHARD-HERMAN,MARIE DENISE,M.D. BSG
07/21/2004 10:30 BROOKS,DAVID C,M.D. BSG
04/27/2004 14:00 GERHARD-HERMAN,MARIE DENISE,M.D. BSG
04/27/2004 14:00 GERHARD-HERMAN,MARIE DENISE,M.D. BSG
09/15/2003 09:30 BUDSON,ANDREW ETHAN,M.D. 221 BRIGHAM MEDICAL
11/12/2002 N/A HURLEY,BEN SOCIAL SERVICES
Allergies
Add New
Allergen Reaction
CEFUROXIME AXETIL - Rash
CEFOTAXIME SODIUM - Hives
Physicians
Add New
Name Service Specialty
Health Maintenance
HM Item Date of Last Result
HCV Ab
test alpha
test HM
Influenza Vaccine 12/17/2003
Viral load
Breast Exam
Cholesterol 09/20/2006 Patient refuses
Mammogram
Pap Smear
Pneumovax
Smoking status
PPD
Hep B Vaccine
Social Service Ref
HBsAB
HCV
Td Booster
Hep A Vaccine
CMV IgG
Triglycerides
CVS PHARMACY #2454
Patient M/A List
Customize
Immunization
Social History
HM Form
Sticky Notes
Add New
Advance Directives

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SFQD R&D Team Acknowledgements

- **Clinical Investigators**
  - Jeff Linder, MD, MPH
  - Jeff Schnipper, MD, MPH
  - John Orav, PhD
- **Clinical Informatics**
  - Jonathan Einbinder, MD, MPH
  - Julie Greim, MSc
  - Tonya Hongsermeier, MD, MBA
  - Qi Li , MD, MBA
  - Maya Olsha-Yehiav
  - Matvey Palchuk, MD, MSc
  - Alan Rose, MSc
- **Clinical and Quality Analysis**
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  - Andrea Melnikas
  - Svetlana Turovsky, MD
  - Lana Tsurikova, MA, MSc
  - Lynn Volk, MA
  - Tony Yu, MD, MSc
- **Application Development**
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  - Nina Plaks
  - Anatoly Postilnik
  - Boris Rudelson
  - Michael Vashevko
- **Clinical Systems Management**
  - Lynn Klokman
  - Eunice Jung
- **Other**
  - Steve Flammini, CTO
  - Joanne Tremblay
  - Cindy Spurr
  - Cindy Bero
  - Liz Mort, MD
  - Alan Cole, MD

AHRQ R01HS015169
Blackford Middleton, PI

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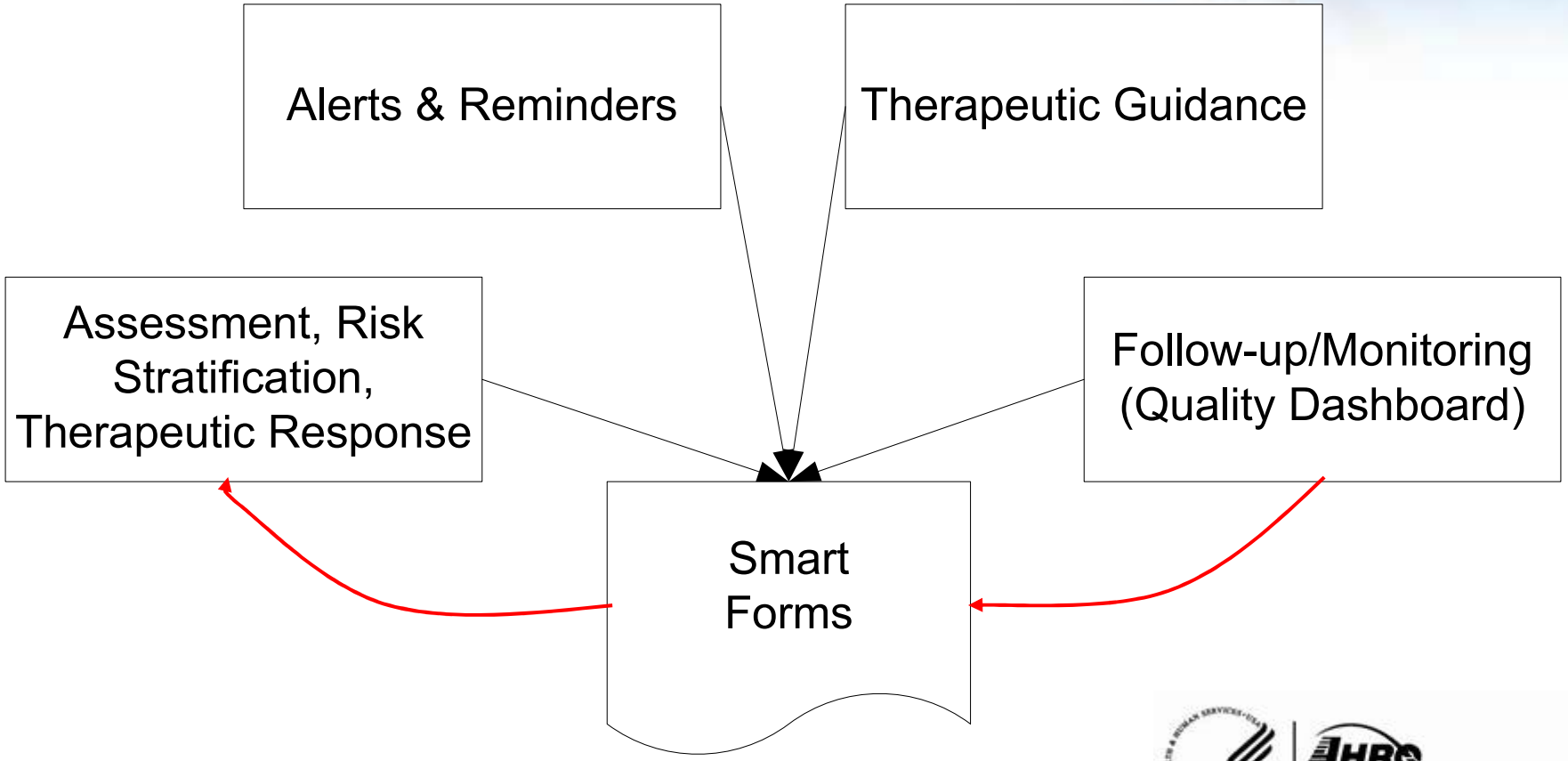
CDSS Integrated into the Clinical Workflow



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Interaction between data, analysis, and user:

- *User* of data is *creator* of data
- Data is collected as a *by-product* of routine care
- Analysis occurs *within* the information environment
- Analytic results are delivered to the provider *during routine care*

Henry SB, Lenert L, Partridge R, Middleton B. Proc HIMSS Ann Conf. 1993;57-81.

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Captain, let me make something clear to you:
I'm a <u>doctor,</u>
not a !&#$%!
computer operator.

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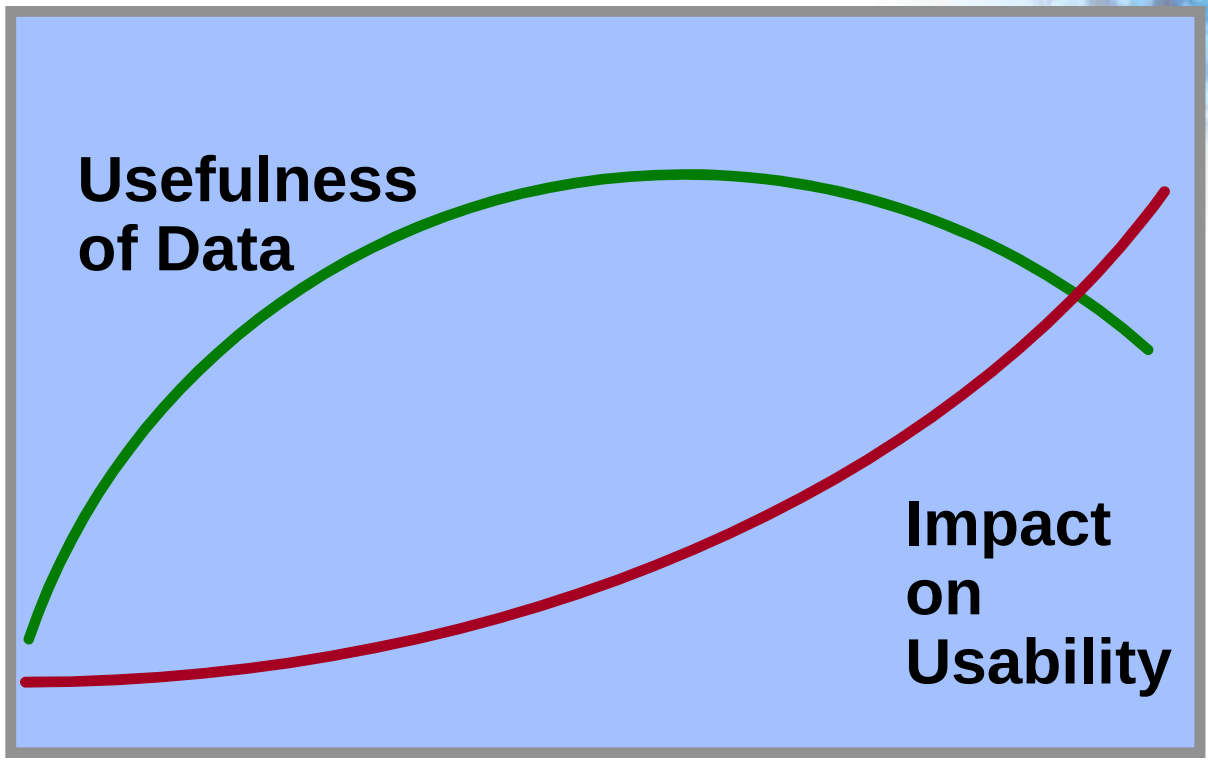
Structured vs. Unstructured Data



100% Free Text

100% Structured& Coded

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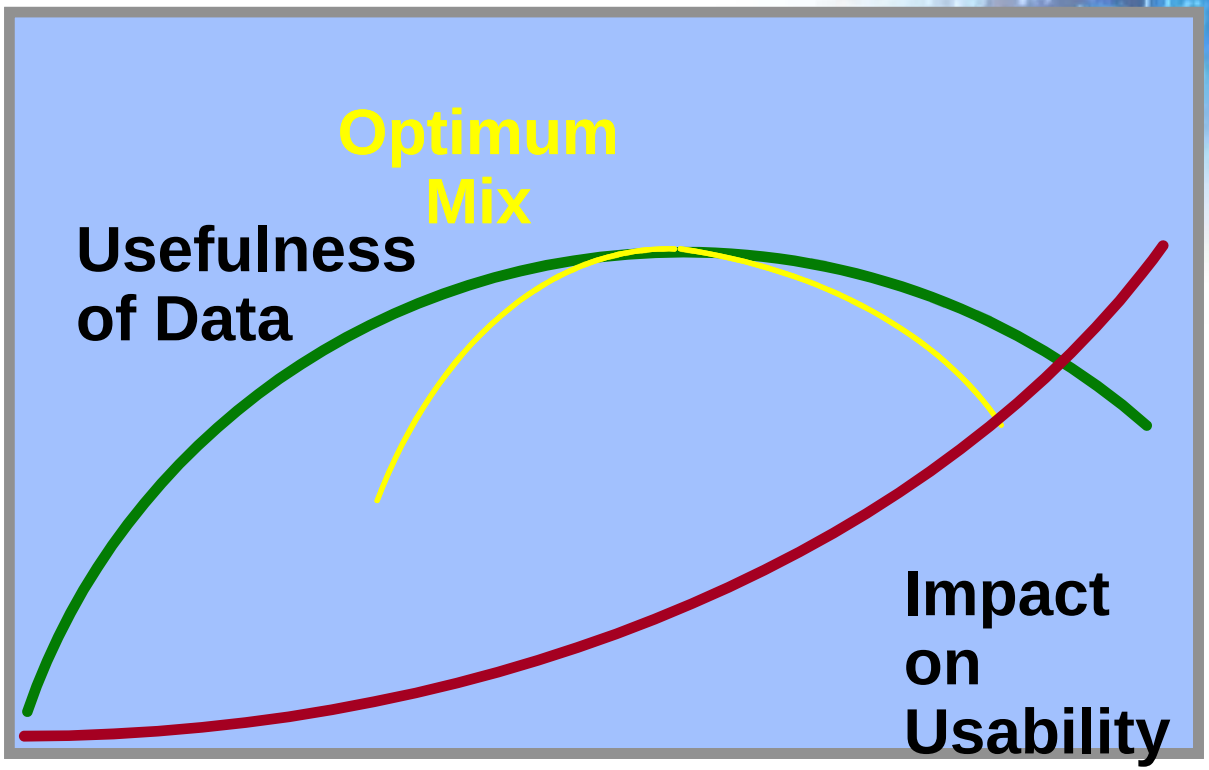
Structured vs. Unstructured Data



100% Free Text

100% Structured & Coded

Middleton B, Renner K, Leavitt MK. Ambulatory Practice Clinical Information Management: Problems and Prospects
J Hlth Info Mgmt, 11;4:97-112, 1997

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SFQD Project Goals

- To develop common framework and approach to integrating improved clinical documentation with decision support in the LMR
  - Primary method will be through use of "Smart Forms"
  - Secondary method will be through use of "Quality Dashboards"

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SFQD Secondary Goals

- To externalize knowledge elements and logic used in LMR smart forms, alerts & reminders, and quality dashboards
- To make use of external rules engine for all LMR clinical inference and decision support
- To improve usability of LMR (market competitiveness)

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SFQD Specific Aims

- Specific Aim 1: To design and implement an **integrated documentation-based clinical decision support and physician feedback system**, provided in an electronic health record (EHR), to improve the management of patients with acute and chronic medical conditions.
- Specific Aim 2: To determine the **effectiveness of documentation-based CDSS and physician feedback** on documentation and the clinical management of patients with coronary artery disease and acute respiratory tract infections.
- Specific Aim 3: To assess the **perceived value** of EHR quality dashboards by clinicians and their marginal impact over smart forms on compliance with best practices in ARI and CAD.

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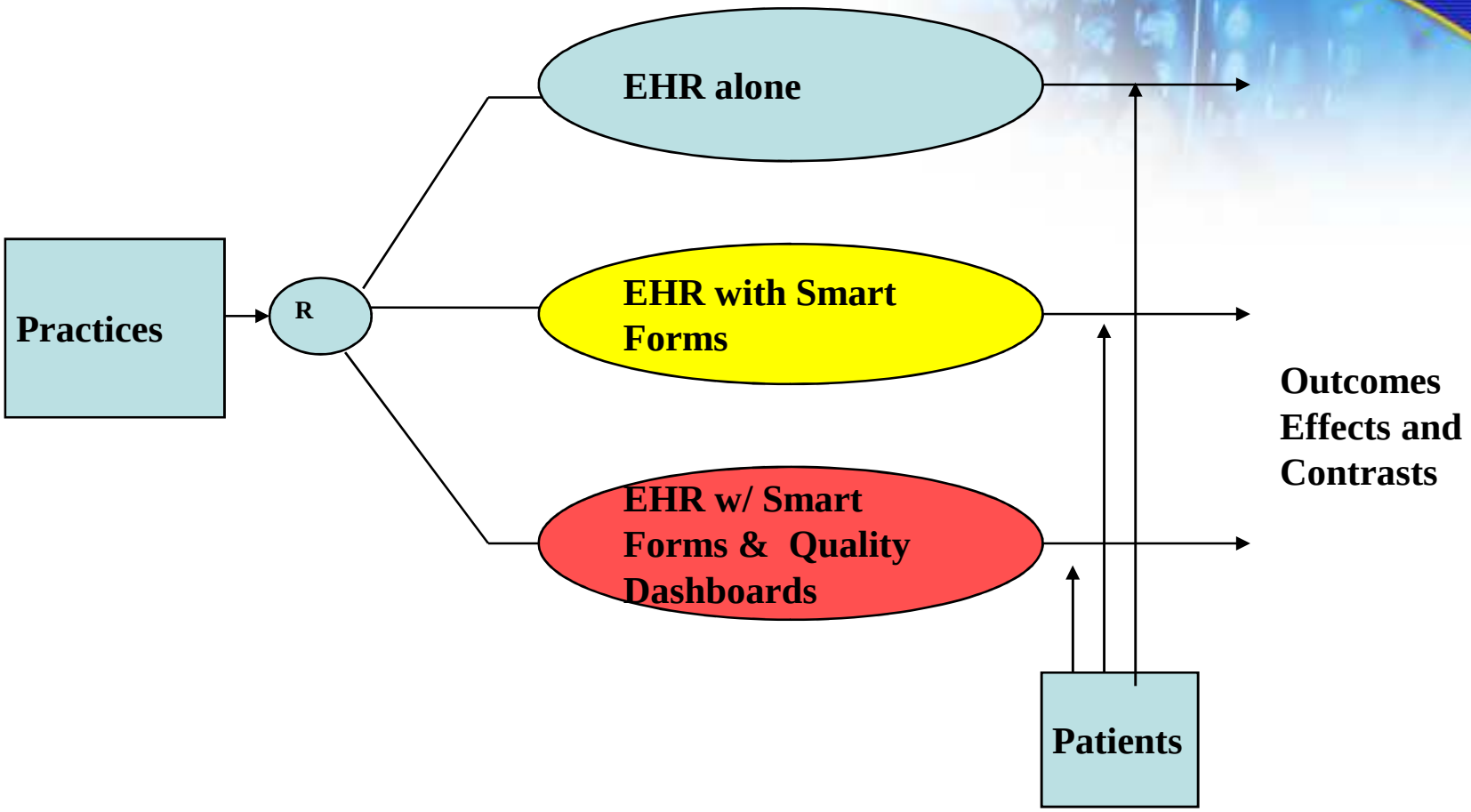
Research Design



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Condition Dichotomy

- ARI
  - Acute condition
  - Errors of commission
  - Often a stand-alone urgent care visit
  - Decision support during visit only
- CAD & DM
  - Chronic conditions
  - Errors of omission
  - Usually in context of a full visit with multiple problems
  - Decision support before, during, and after visit

Limited Time | Competing Demands

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What is a Smart Form?

- Clinical documentation-based
- Actively engage user during workflow
- Organize relevant data
- Request new data
- Integrate decision support, ordering, patient education, and documentation

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ARI Smart Form Features

- Structured data entry
- Patient data display
- Diagnosis detection
- Presentation of treatment options with integrated decision support
  - Based on coded data and final diagnosis (e.g., probability of strep throat)
- Printing of patient handouts
- Access to medical literature

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ARI Smart Form

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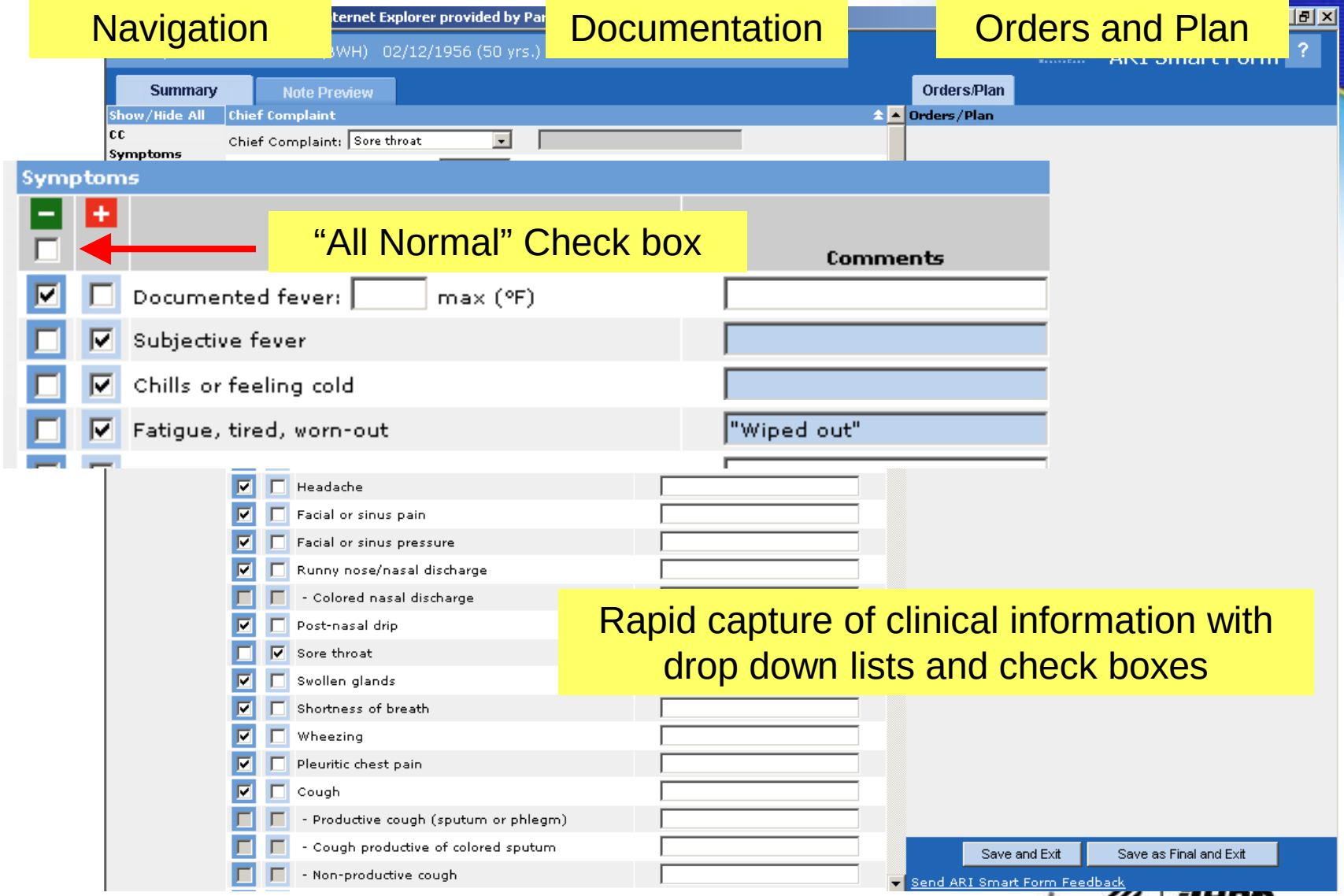
Navigation

Documentation

Orders and Plan



Rapid capture of clinical information with drop down lists and check boxes

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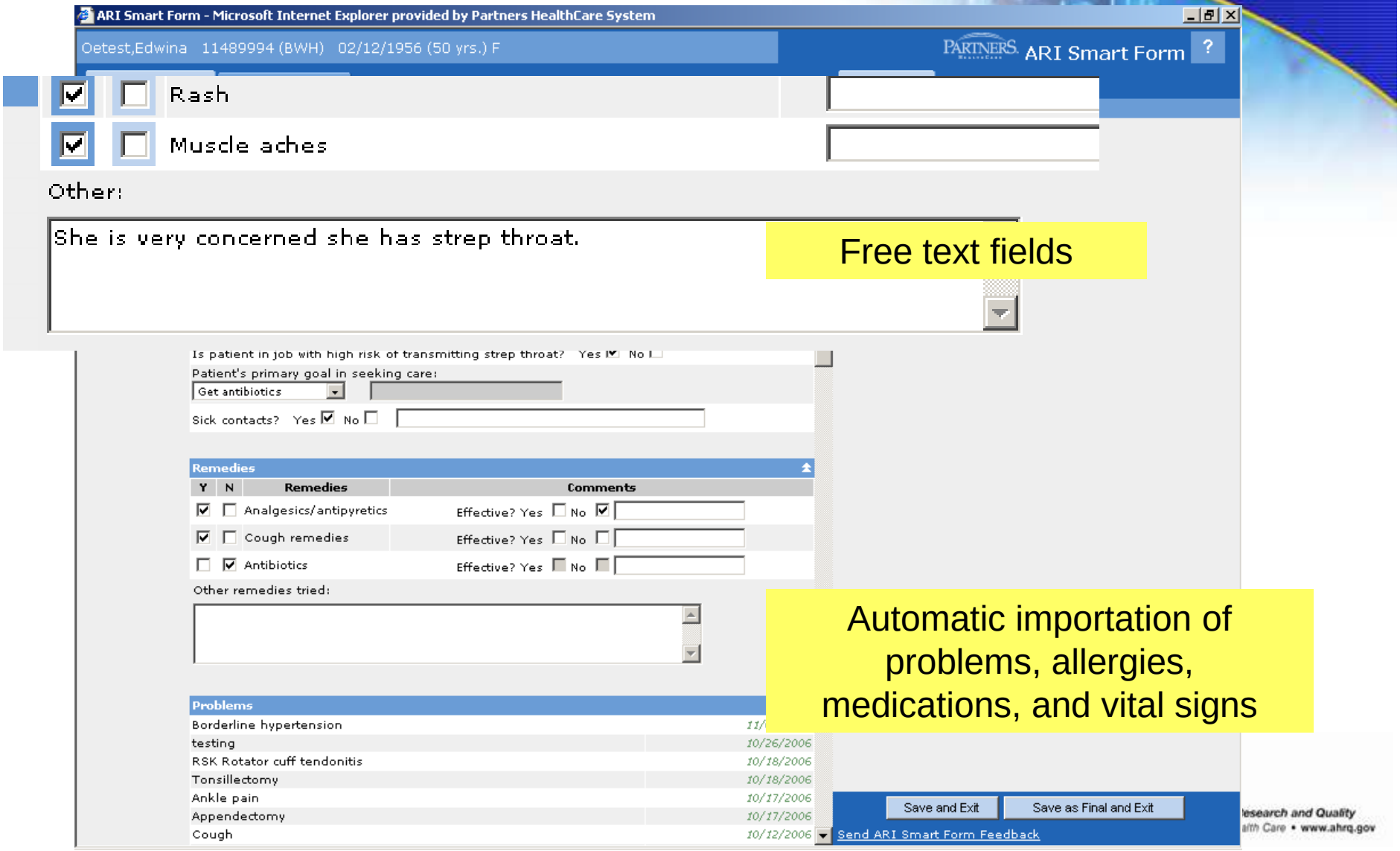
ARI Smart Form



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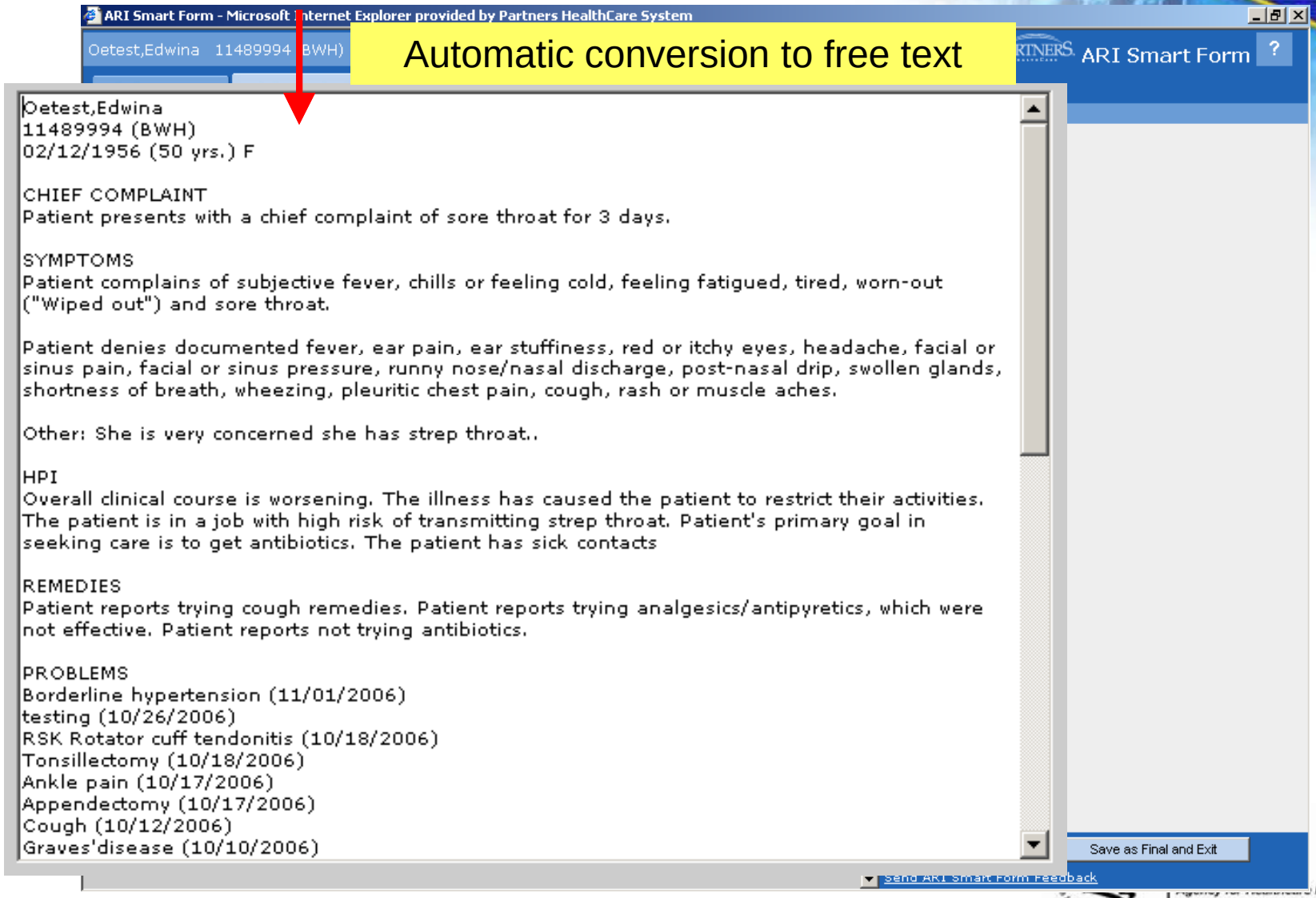
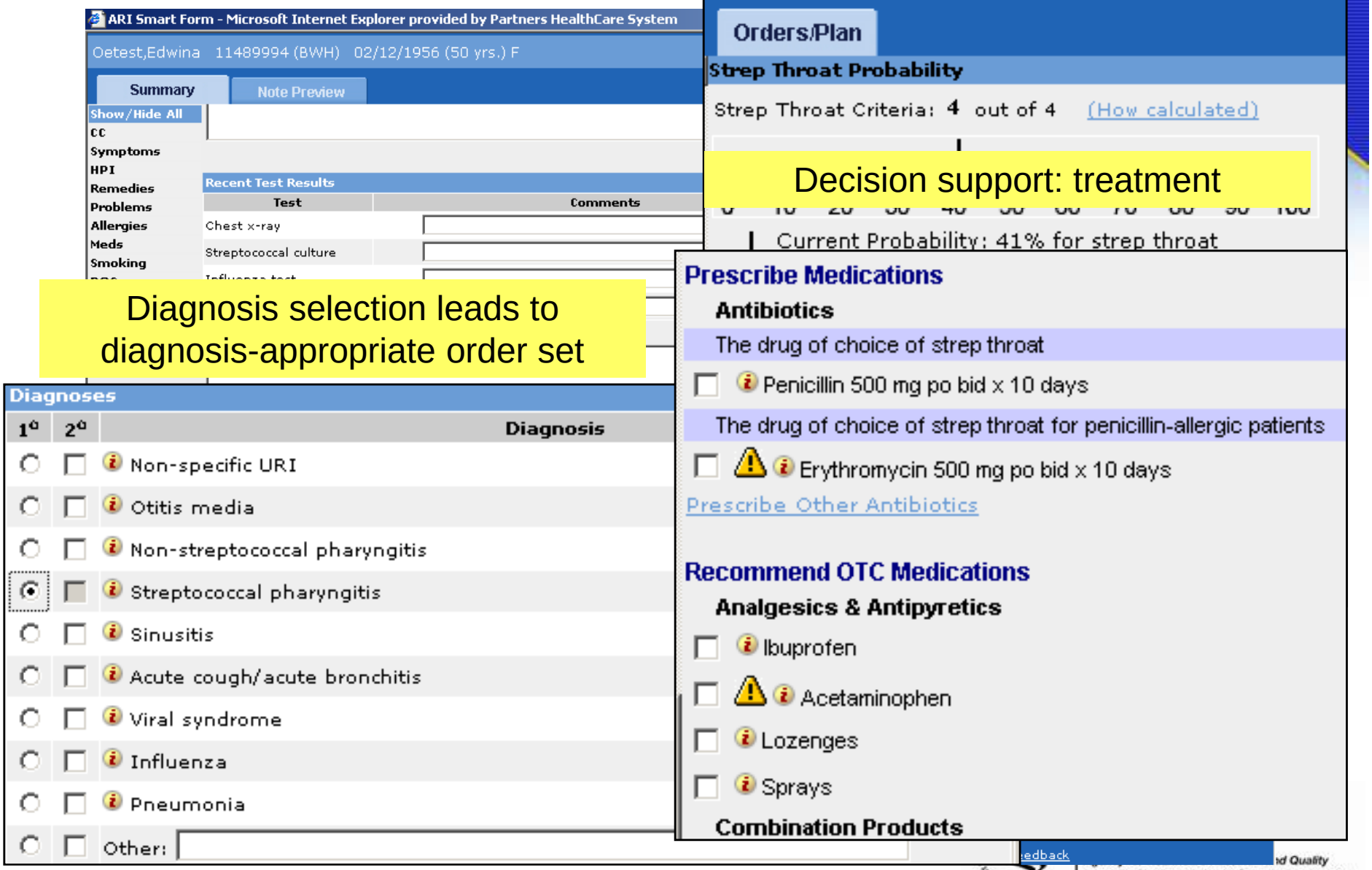


ARI Smart Form

Decision support: diagnosis

Decision support: treatment

Diagnosis selection leads to diagnosis-appropriate order set



ARI Smart Form

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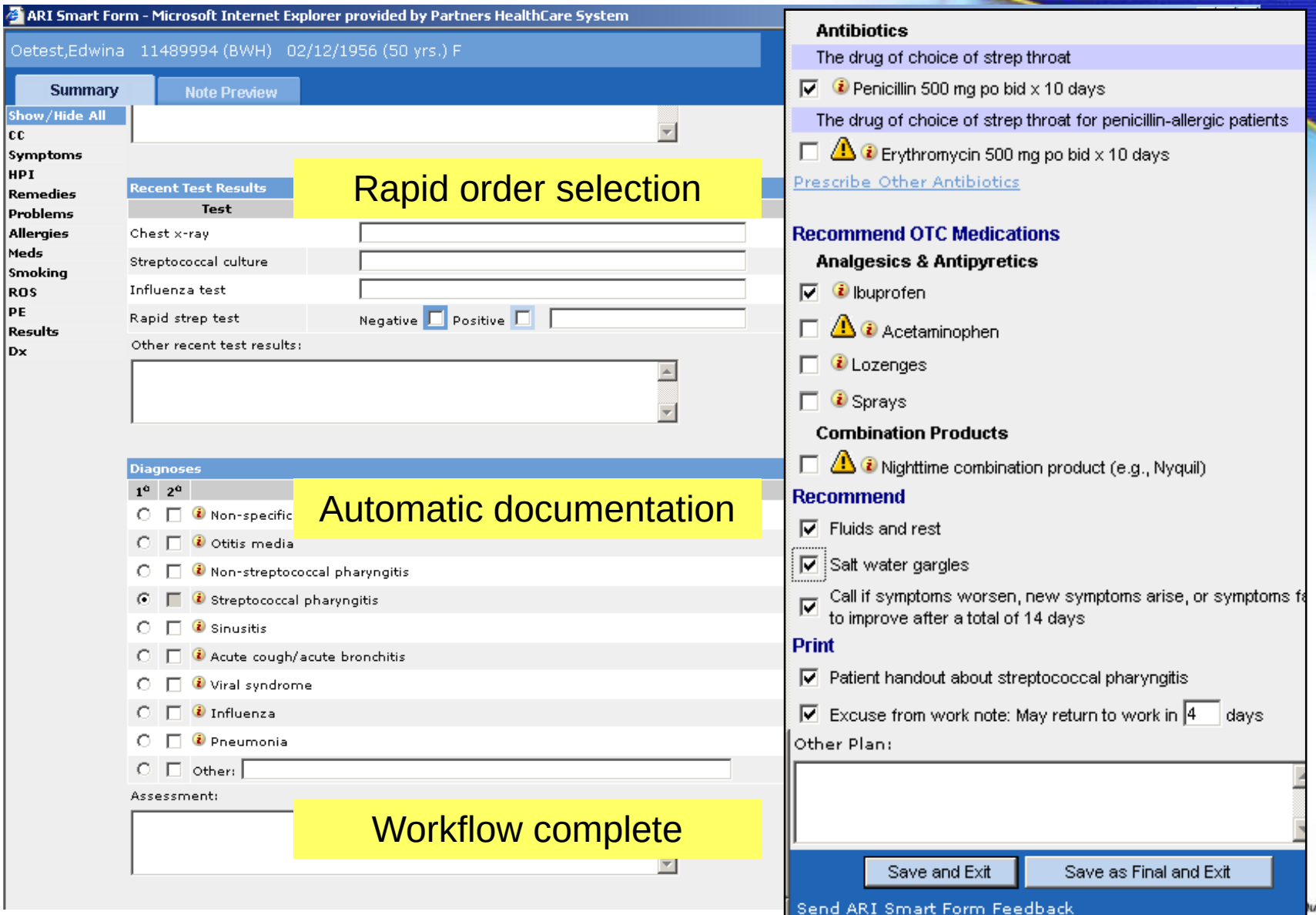

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CAD / Diabetes Smart Form

- Integrated into a full visit note
- Customized views tailored to medical condition(s) of the patient
- Central note-writing section
  - Multiple ways to document a note
  - “Formlets” for selected coded data entry
- Decision support section
- Patient View
  - Activates patient around goals of care

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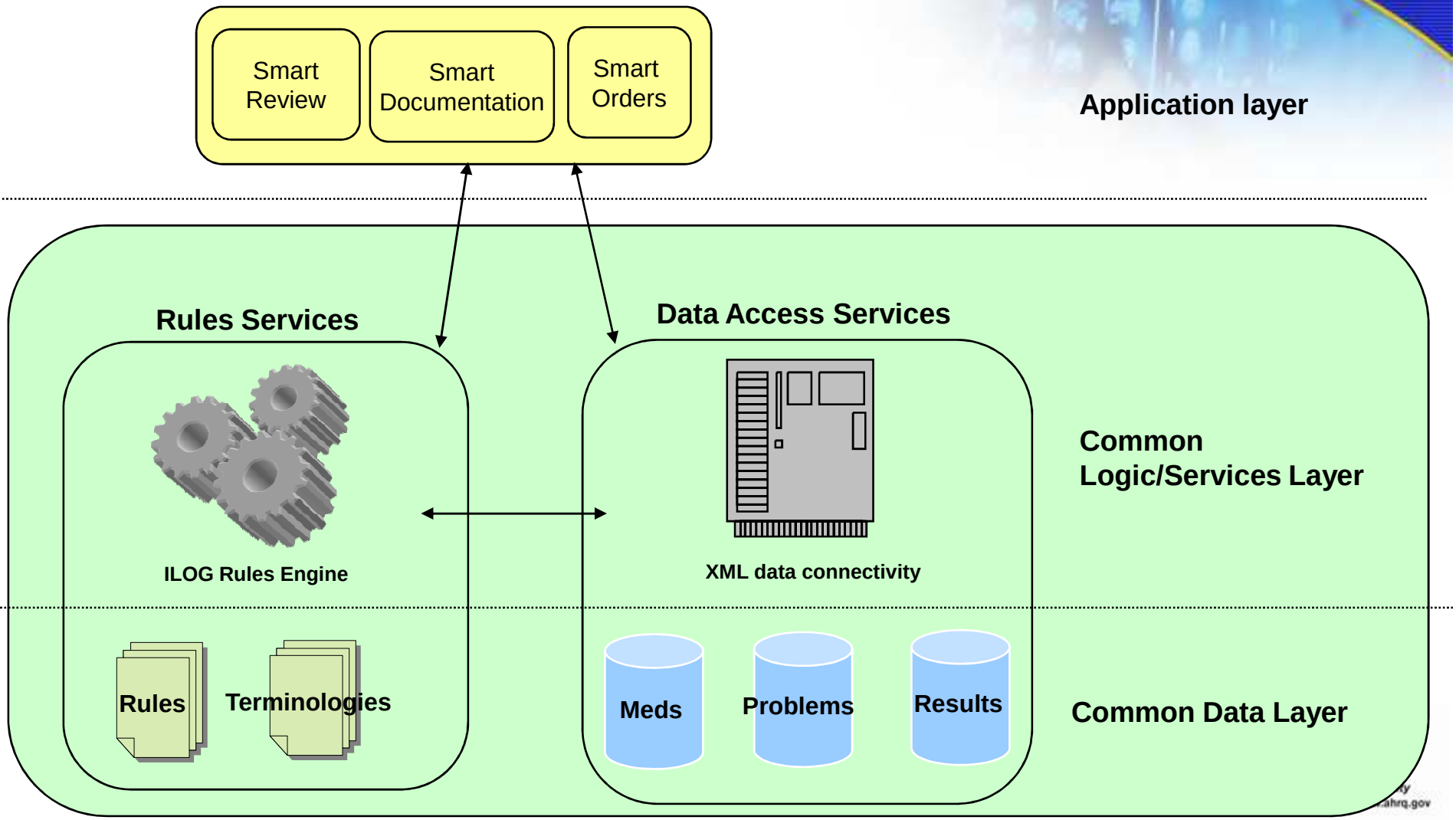
Smart Forms – a composite application, based on SOA



CAD/DM Smart Form

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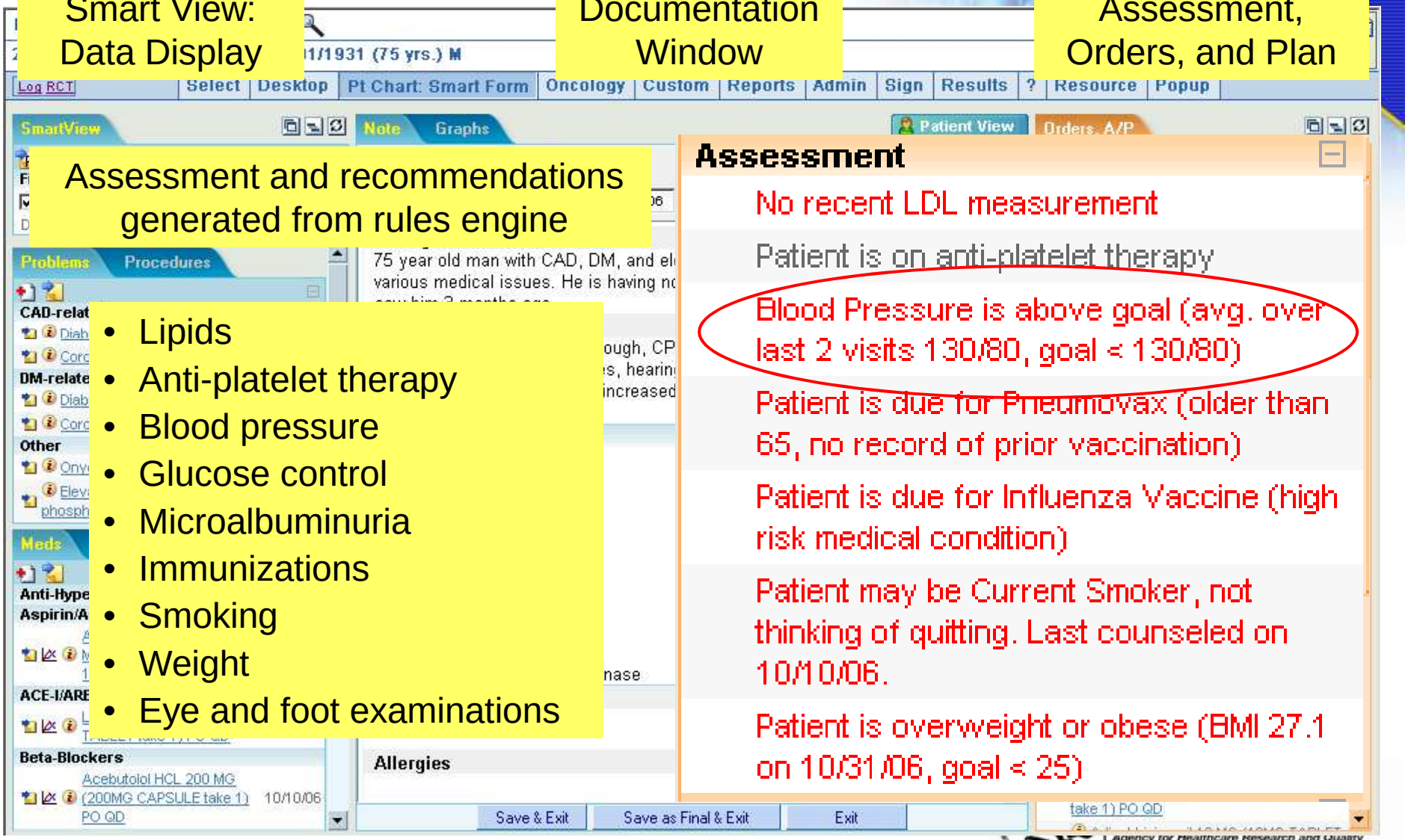
Smart View: Data Display

Documentation Window

Assessment, Orders, and Plan



Assessment and recommendations generated from rules engine

- Lipids
- Anti-platelet therapy
- Blood pressure
- Glucose control
- Microalbuminuria
- Immunizations
- Smoking
- Weight
- Eye and foot examinations

CAD/DM Smart Form

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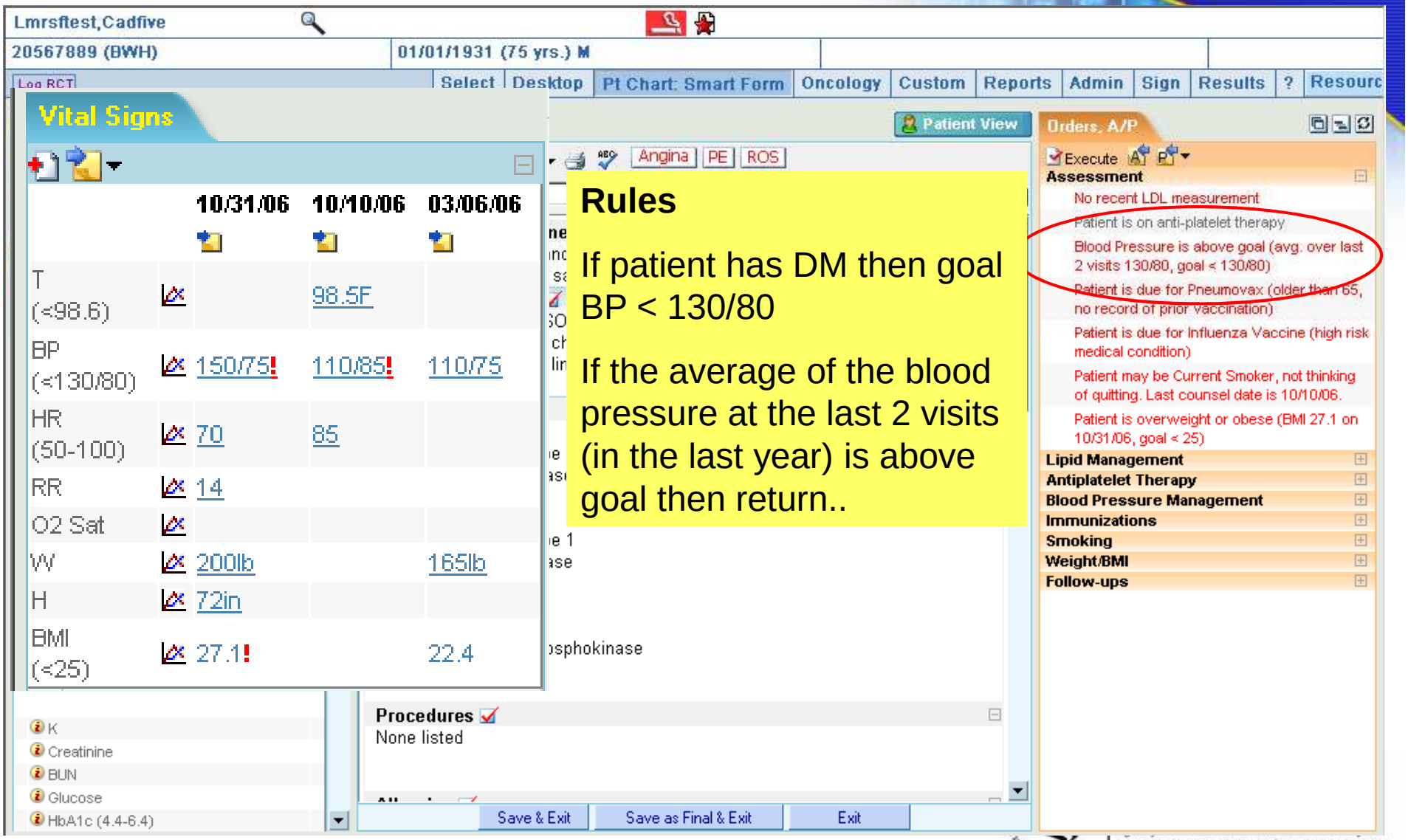

Rules

If patient has DM then goal BP < 130/80

If the average of the blood pressure at the last 2 visits (in the last year) is above goal then return..

CAD/DM Smart Form

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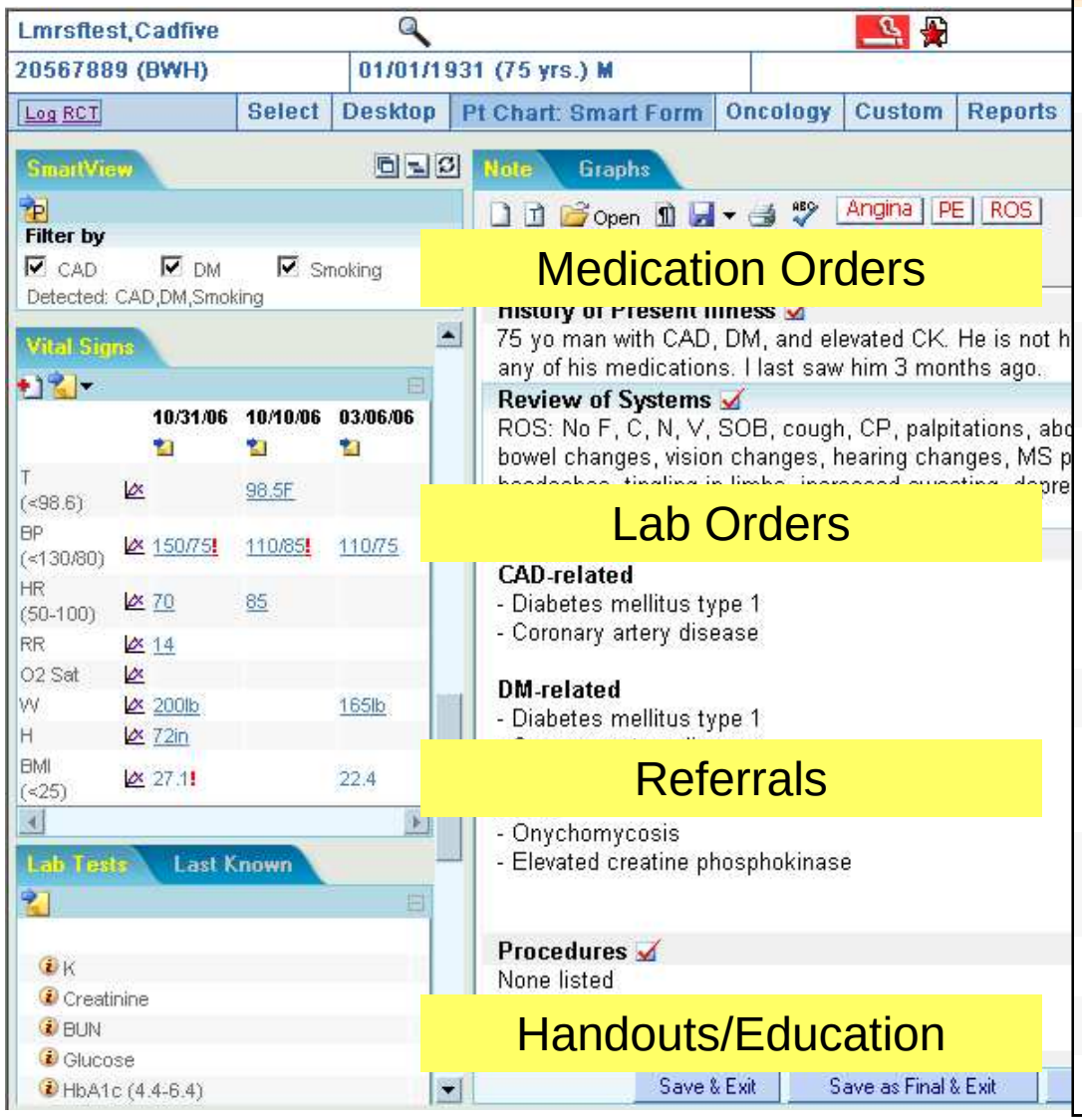
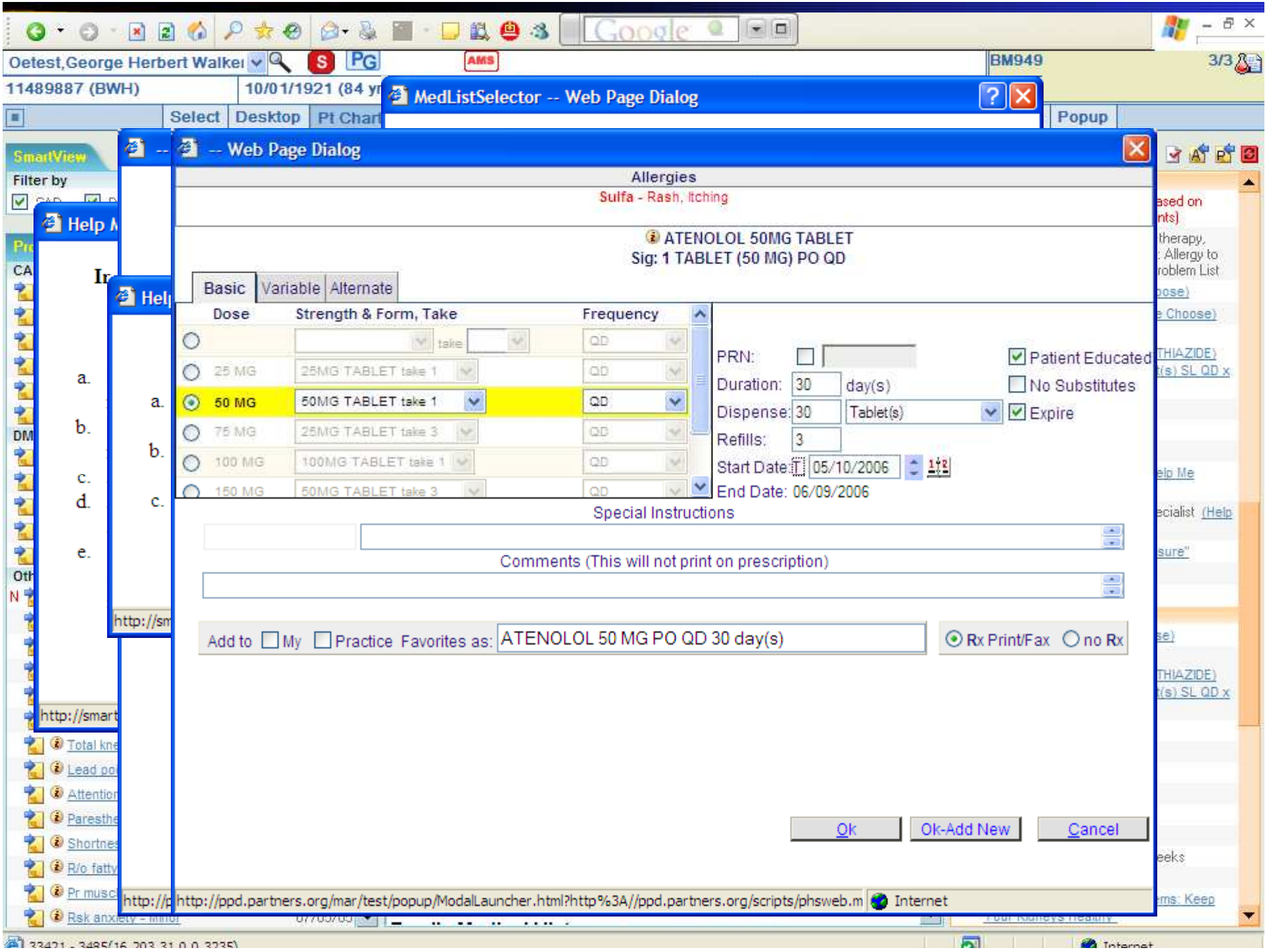


Blood Pressure Management

Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)

- Start an Other Anti-Hypertensives (Help Me Choose)
- Adjust Oretic 25 MG (25MG TABLET take 1) PO QD
- Adjust Lisinopril 20 MG (20MG TABLET take 1) PO QD
- Adjust Acebutolol HCL 200 MG (200MG CAPSULE take 1) PO QD
- ☐ Order Chem 7 now
- ☐ Order Chem 7 in 4 Weeks
- ☐ Referral to Nutritionist
- ☐ Referral to Cardiac Rehab (Help Me Choose)
- ☐ Referral to Blood Pressure Specialist (Help Me Choose)
- ☐ Print "Control High Blood Pressure"
- ☐ Print DASH diet instructions
- ☐ Print exercise "prescription"


MedListSelector -- Web Page Dialog
-- Web Page Dialog
Allergies
Sulfa - Rash, Itching
ATENOLOL 50MG TABLET
Sig: 1 TABLET (50 MG) PO QD
Basic
Variable
Alternate
Dose
Strength & Form, Take
Frequency
25 MG
25MG TABLET take 1
50 MG
50MG TABLET take 1
75 MG
25MG TABLET take 3
100 MG
100MG TABLET take 1
150 MG
50MG TABLET take 3
QD
PRN:
Duration: 30 day(s)
Dispense: 30 Tablet(s)
Refills: 3
Start Date: 05/10/2006
End Date: 06/09/2006
Patient Educated
No Substitutes
Expire
Special Instructions
Comments (This will not print on prescription)
Add to My Practice Favorites as: ATENOLOL 50 MG PO QD 30 day(s)
Rx Print/Fax
no Rx
Ok
Ok-Add New
Cancel
http://ppd.partners.org/mar/test/popup/ModalLauncher.html?http%3A//ppd.partners.org/scripts/phsweb.m
Internet

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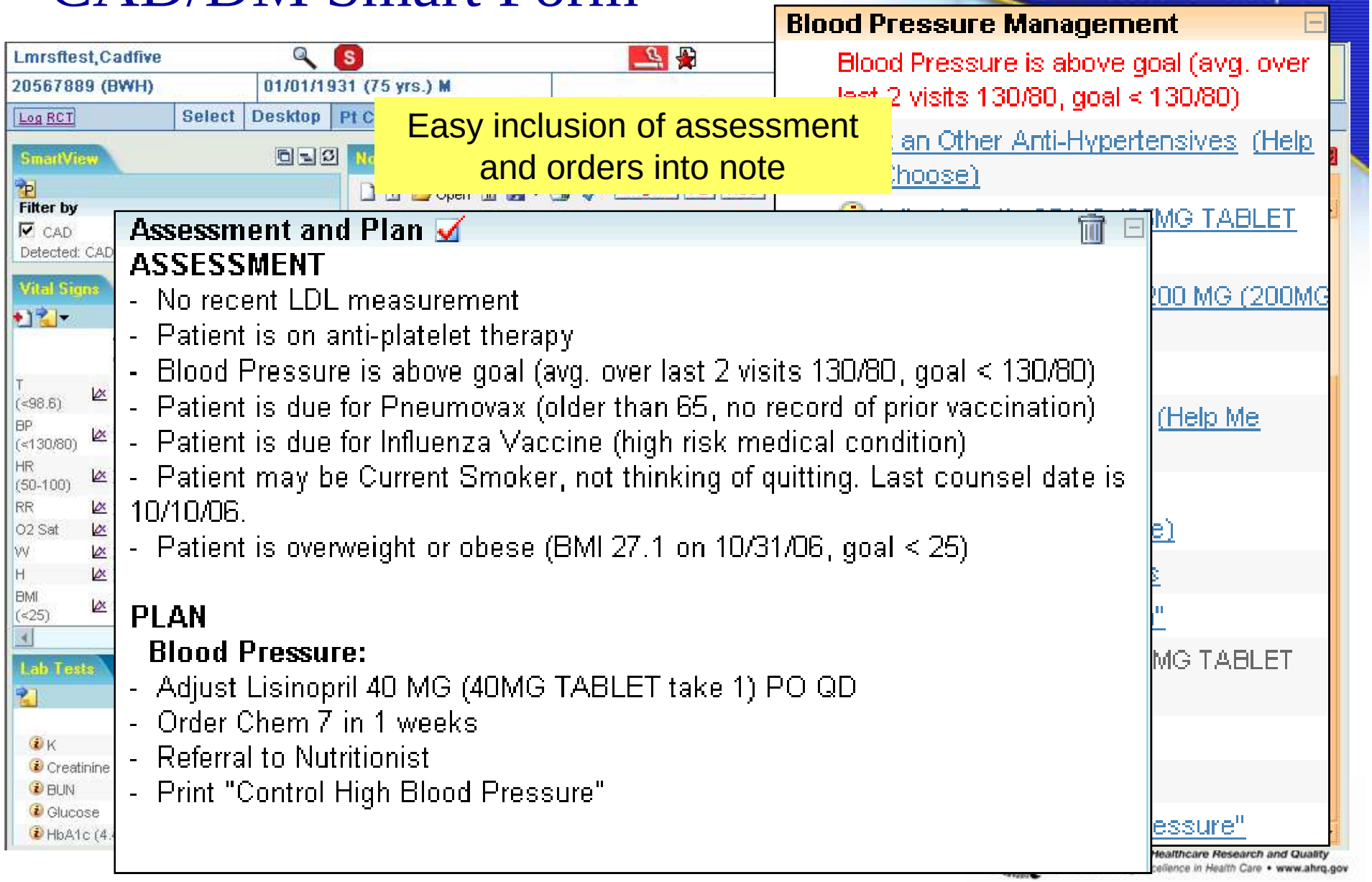
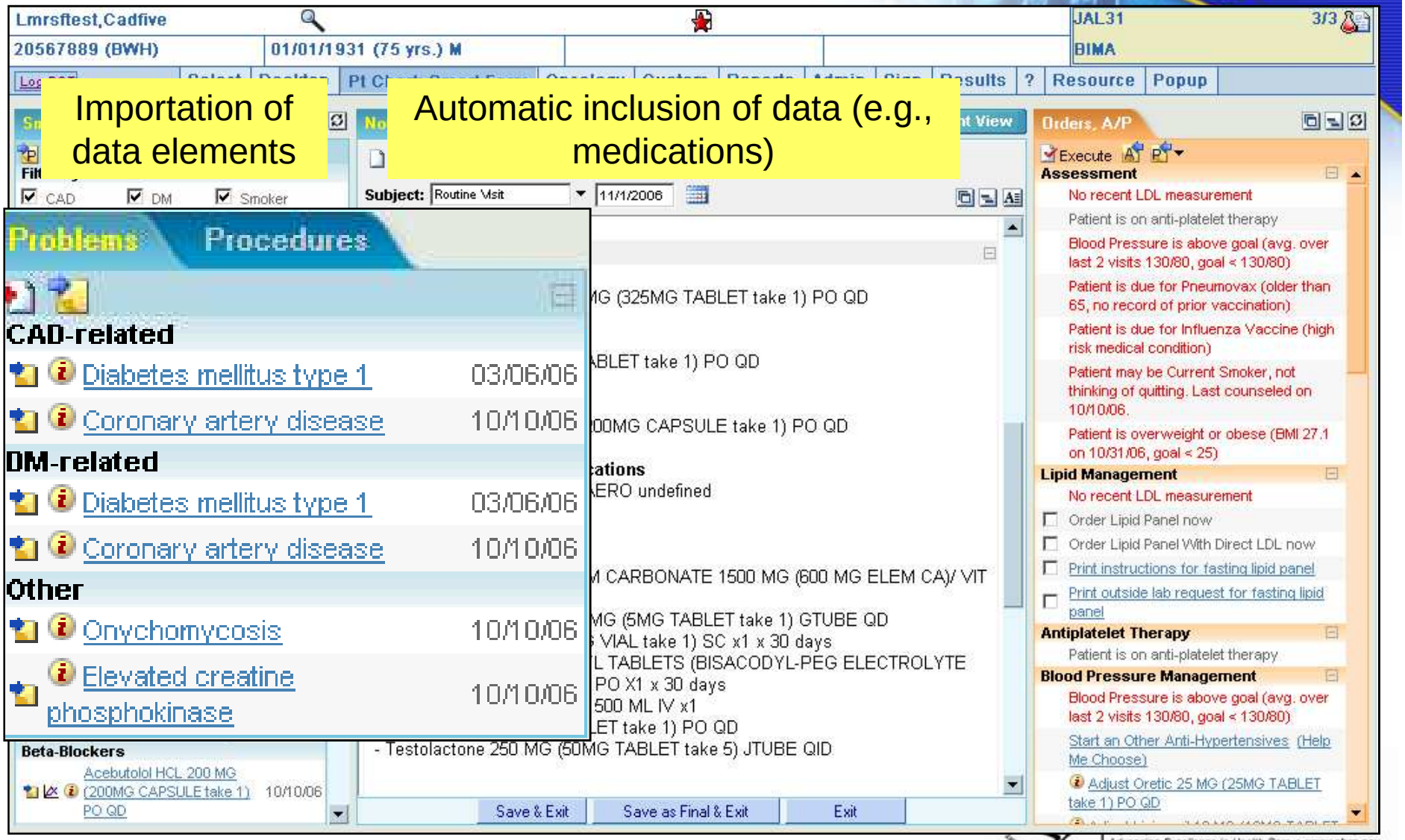


Easy inclusion of assessment and orders into note

CAD/DM Smart Form: Workflow



CAD/DM Smart Form: Workflow

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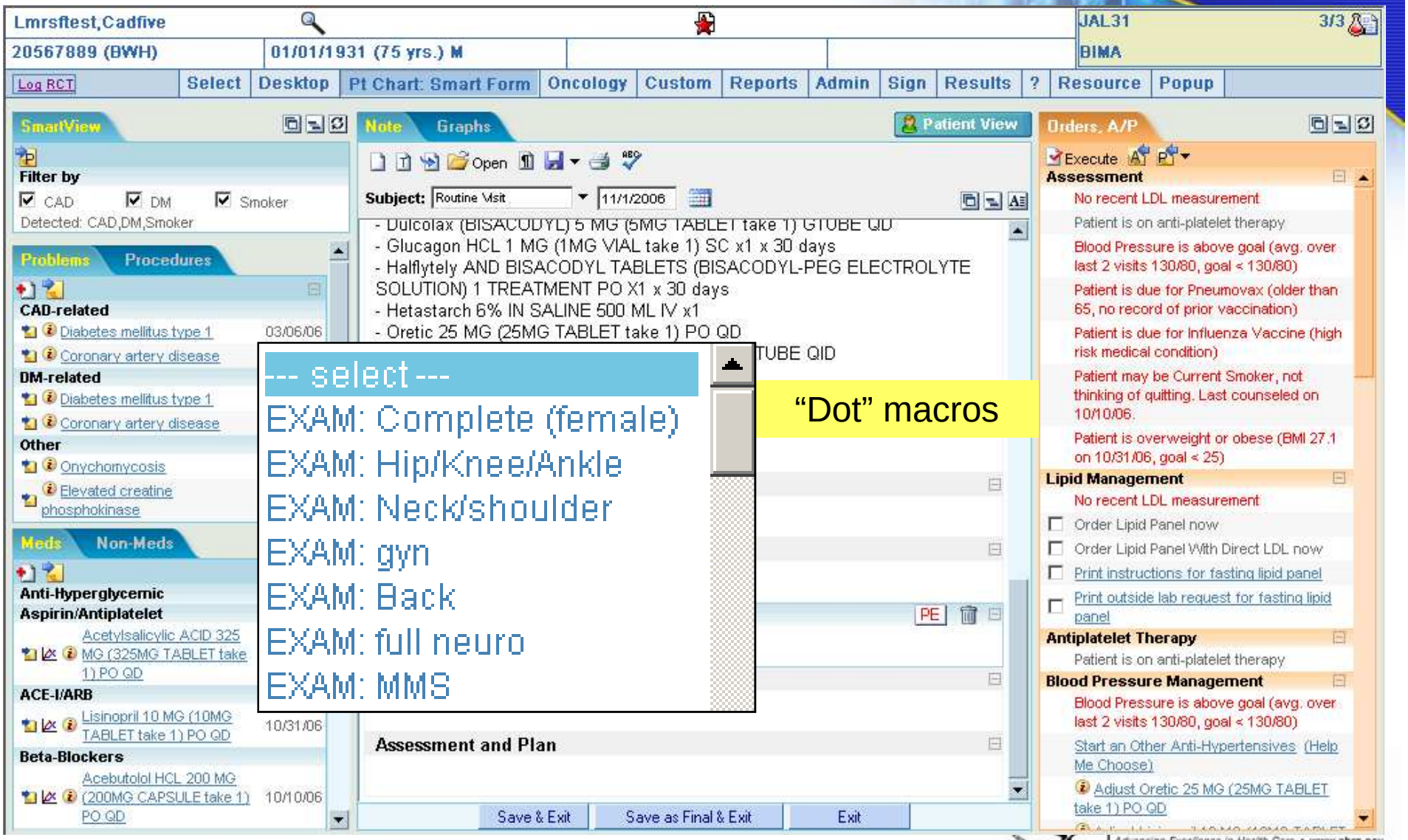

CAD/DM Smart Form: Workflow

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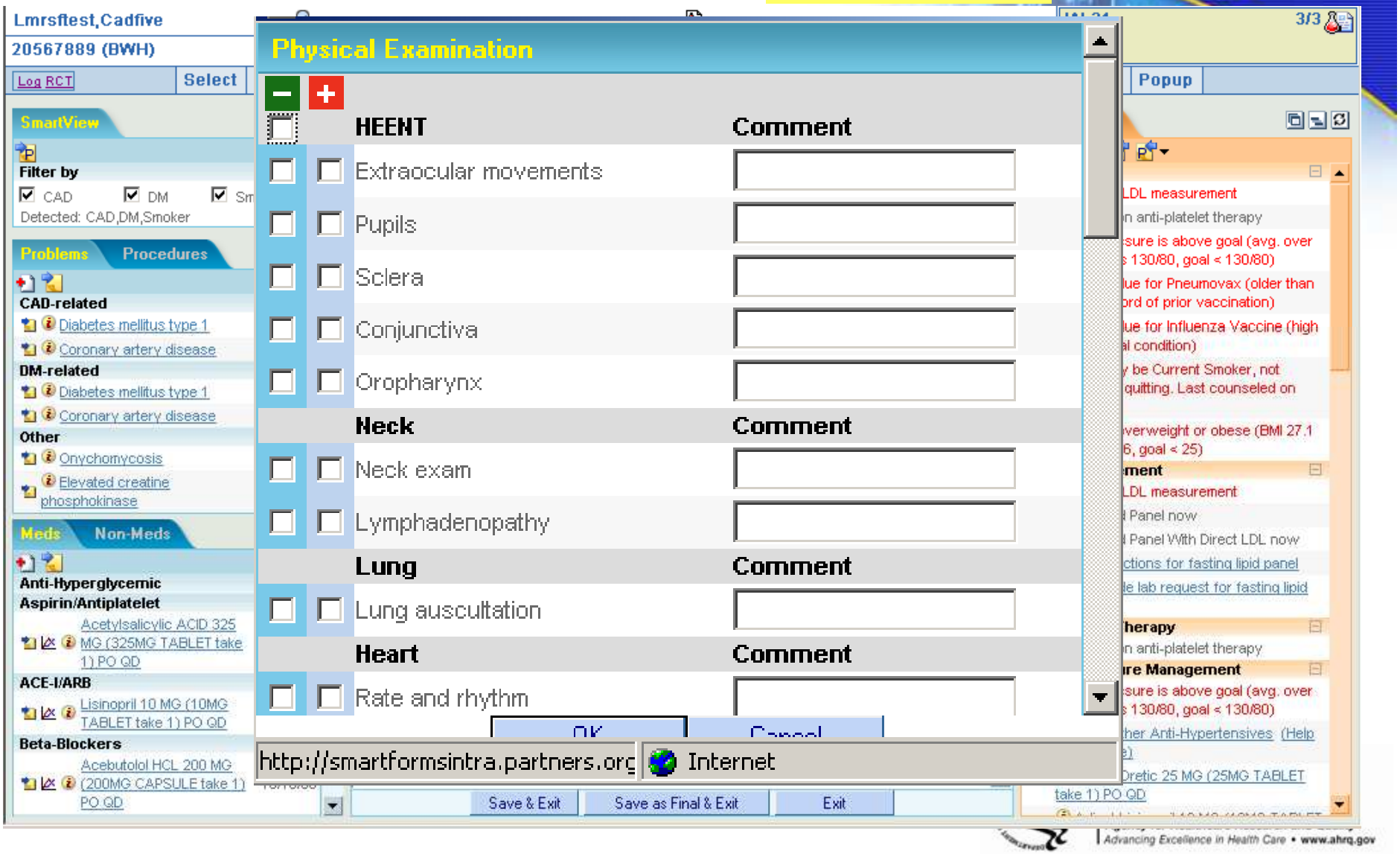
Formlets



CAD/DM Smart Form: Graphs

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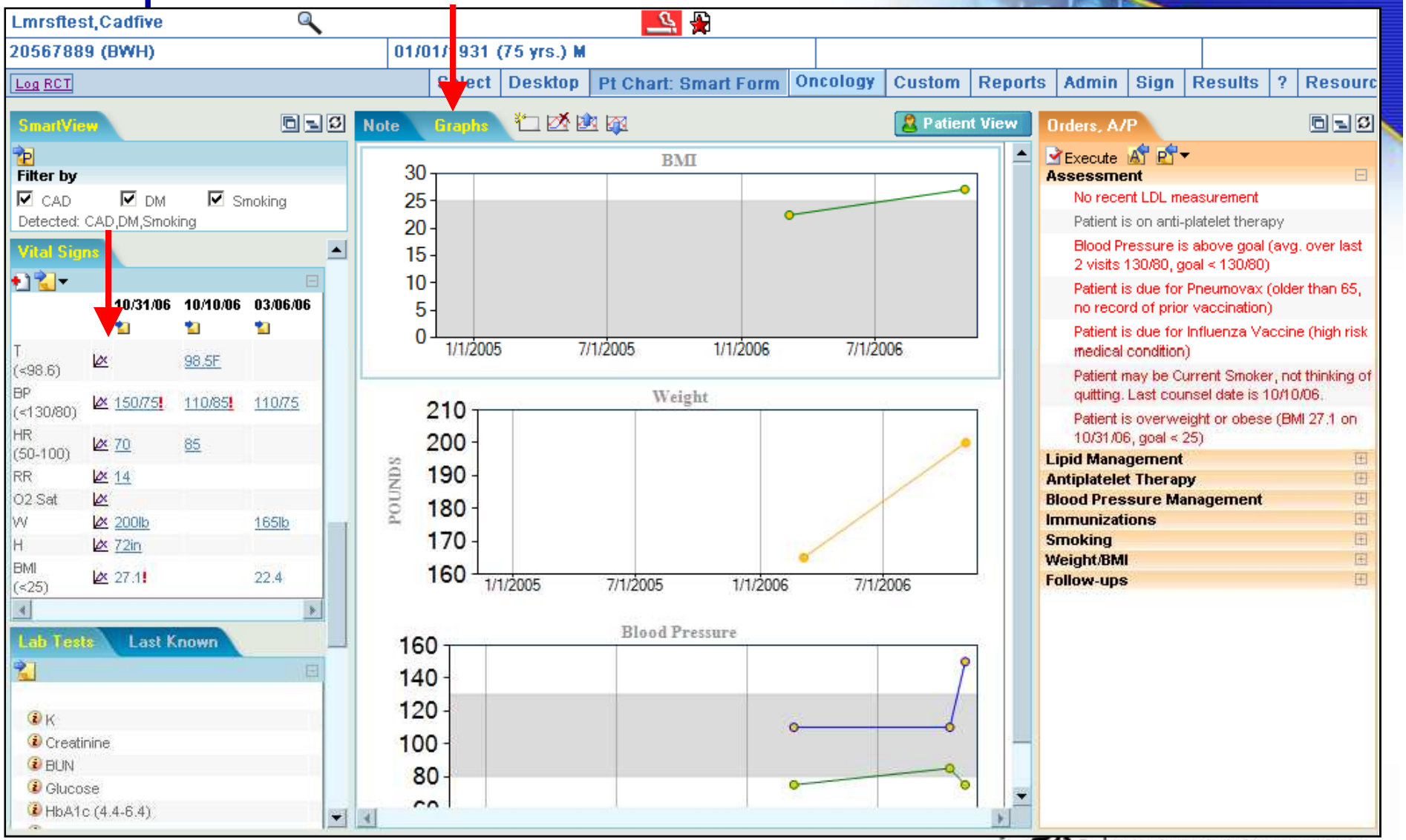

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CAD/DM SF: Patient View

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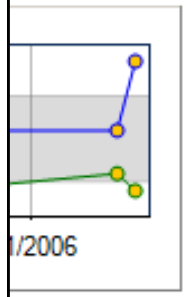
Blood Pressure

On average, your blood pressure has been running high recently (average of 130/80 from your last two doctor visits). The recommended blood pressure goal is 130/80. You may want to discuss with your doctor about things you can do to help lower your blood pressure.



pneumonia at least once. If you have not had a pneumonia shot, you may want to discuss with your doctor whether you should get a pneumonia shot.

Most people with medical conditions such as yours receive a flu shot every year. If you have not had a flu shot this year, you may want to discuss with your doctor's office whether you should get a flu shot.

Smoking

If you are currently a smoker, you may want to talk to your doctor about ways to help you quit.

ARI and CAD/DM Pre Survey: Overall EHR use

- 223 clinicians responded (response rate 45%).
- Respondents had a mean age of 39 years old and were 40% men.
- Respondents were 197 physicians (88%), 24 nurse practitioners (11%), and 4 other clinician types (2%), including registered nurses and licensed practical nurses.
- Trainees – interns, residents, and fellows – made up 92 (41%) of respondents.

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Pre survey contained questions about baseline computer use and about electronic health record use during patient visits.

Table 1: Reported Activities during Patient Visits*

During the visit, do you…	N	Never	Sometimes	Usually	Always
		N (%)			
Electronic health record use					
Correct/update the medication list?	221	24 (11)	45 (20)	85 (38)	67 (30)
Write at least part of the note?	220	65 (30)	59 (27)	48 (22)	48 (22)
Correct/update the problem list?	221	53 (24)	95 (43)	52 (24)	21 (10)
Correct/update health maintenance information?	221	60 (27)	97 (44)	47 (21)	17 (8)
Write full notes?	218	116 (53)	55 (25)	25 (11)	22 (10)
Modify the last note or template?	217	103 (47)	68 (31)	31 (14)	15 (7)
Correct/update other parts of the LMR?	191	102 (53)	50 (26)	30 (16)	9 (5)
Paper Use					
Write on the mini face sheet?	210	105 (50)	42 (20)	21 (10)	42 (20)
Write on a blank piece of paper?	213	74 (35)	75 (35)	32 (15)	32 (15)

*Rows may not add to 100% because of rounding.

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Barriers to using the EHR during the patient visit

- The most commonly selected listed reasons for not using the EHR during patient visits were (N=223):
  - loss of eye contact with patient (62%)
  - falling behind schedule (52%),
  - computers being too slow (49%),
  - inability to type quickly enough (32%),
  - feeling that using the computer in front of the patient is rude (31%),
  - preferring to write long prose notes (28%).
- Less commonly indicated barriers included
  - computers “timing out” (19%),
  - a lack of fast, available printers (12%),
  - pop-up blocking software that interfered with the EHR (8%),
  - a lack of computers in some exam rooms (4%).

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ARI RCT Post Survey

- A total of 73 intervention clinicians responded for a response rate of 28%.
- 56% (41) had used the ARI Smart Form during the RCT period.
- 75% of survey respondents said they would recommend the ARI Smart Form to a colleague.

Questions rated on a scale from 1-7 (1= Strongly Disagree, 7= Strongly Agree)	**N responded**	**Mean**
Recommendations in the ARI Smart Form are correct for my patients	41	5.34
The ARI Smart Form helps me comply better with ARI guidelines	41	4.68
The ARI Smart Form helps me improve quality of patient care	41	4.37
The ARI Smart Form is easy to use	40	3.92
The ARI Smart Form saves me time in the end	41	3.83
The ARI Smart Form improves my workflow	40	3.87
The ARI Smart Form has all the functions and capabilities that I expect it to have	40	4.23
I feel comfortable using the ARI Smart Form	40	4.47
The ARI Smart Form requires too many "clicks"	41	4.46

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We also asked them to rate which Smart Form features they thought were most helpful.

Which ARI Smart Form features do you find to be the most helpful?	**N (%)**
Organizing data	14 (34)
Calculating risk of strep throat for ARI	13 (32)
Providing decision support	14 (32)
Documenting actions	20 (49)
Making it easier to prescribe medications	14 (32)
Making it easier to print patient instructions	25 (61)

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ARI Smart Form Feedback

“Usually I do my notes after clinic ends and so I end up writing down hx and physical in brief short hand but with ARI I did note while patient was still there and did rx via ARI which is great!”

“The link to print work notes and patient information sheets are very nice. I woul definitely use this as a documentation tool for URIs. I find it is as fast to use as my templated notes even for very simple things like pharyngitis.

"Overall I like it…And I think the recommendations are good which is obviously the most important thing."

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CAD/DM Smart Form Post Pilot Survey

- We asked the CAD/DM pilot users (31) to fill out an online survey after using the CAD/DM Smart Form for 6 weeks.
- 15 pilot users (48%) completed the post pilot survey.
- 11 of these 15 (73%) users also completed the pre survey, allowing us to compare their pre and post responses.
- Of those 15 users, 10 (66%) would recommend the Smart Form to other clinicians unchanged.
- The other 5 suggested improvements we could make to the Smart Form that would make them more likely to recommend it.
- At least two of their suggestions have been implemented already for the RCT release.

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CAD/DM Post Pilot Survey

- Survey results suggest that pilot users can see the benefits of using the CAD/DM Smart Form to treat patients with corresponding conditions.
- The majority of pilot clinicians agree that the CAD/DM SF helps them comply better with guidelines (60%) and helps them improve the quality of patient care (67%).

Question	% Agree or Strongly Agree
The CAD/DM SF helps me comply better with guidelines	60
The CAD/DM SF helps me improve quality of patient care	67
The CAD/DM SF is easy to use	20
The CAD/DM SF saves me time in the end	7
The CAD/DM SF improves my workflow	20
The CAD/DM SF has all the functions and capabilities that I expect it to have	13
The CAD/DM SF works well with the rest of the office staff	13

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Most helpful Smart Form features

Features Most Helpful	% Agree or Strongly Agree
Providing assessments for each area of disease management	60
Organizing data	53
Providing suggested orders based on individual patient data	53
Printing patient instructions	53
Requests to provide patient info	47
Prescribing new medications	40
Adjusting existing medications	40
Documenting actions taken in the note	33
"Help Me Choose" links	27
Ordering follow-up appointments and referrals	20
Making it easier to write a visit note	13
Ordering laboratory tests	13

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Pre and Post Comparison

How satisfied are you with your ability to carry out the following components of chronic disease management?

Percent satisfied or very satisfied:

	Pre Survey %	Post Survey %
Smoking	**47**	**57**
Weight	**17**	**21**
Diet and Exercise	**6**	**29**

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CAD/DM SF Feedback

"This is the first LMR item that has allowed updating the health maintenance (smoking status) this is great."

"I like the graphs…and to be able to put them in the note and have them right there without having to go out of the note is really nice."

"What I like about the Smart Form is the way it sorts through the med and problem lists."

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More CAD/DM SF Feedback

Alan Cole, MD, Charles River Medical Associates, Chair of Partners Diabetes Council:

"The Smart Form is the easiest way to use the LMR. It provides access to vital signs and most labs and, in addition, permits entry of some data elements (e.g. vital signs and some Health Maintenance items) without screen changes or pop-ups. The Smart Form's decision support functionality assists compliance both by identifying deficits and streamlining most opportunities for correction. There are built-in individualized print- outs that serve as teaching tools that are useful and appreciated. I find myself using the Smart Form 5-10 times every day."

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Elizabeth Mort, MD, MPH, Associate Chief Medical Officer, MGH, HPM3 Team Leader :

"The Smart Form allows me to *act* on information rather than spending time pulling it together. The trend graphics have made it easier to show patients where they are and where they need to be. I had a very difficult to manage, noncompliant patient with an A1C of 14. Showing the patient and her granddaughter the Patient View was critical in getting the whole family organized to support the patient. Her A1c came down to less than 9."

Deborah Wexler, MD, MGH Diabetes Center :

The Smart Form is easy to use. It's fast and has some fabulous features (PE, ROS). BRAVO! I really think the Smart Form is time-saving."

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What is a Quality Dashboard?

- Physician feedback system
- Clinician-level view of performance on problem-oriented quality indicators
- Comparison to:
  - Clinic
  - National benchmarks
- Drill-down capability
  - Summary measures → List of Individual Patients → Patient Charts/Smart Form

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ARI Quality Dashboard Features

- Focus on total and unnecessary antibiotic use
- Narrow vs. broad spectrum antibiotics
- Stratified by type of ARI
- Relatively static because no further action can be taken on that patient

ARI Quality Dashboard

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Total ARI cases: 107
Antibiotic prescribing: 40

% ARI visits

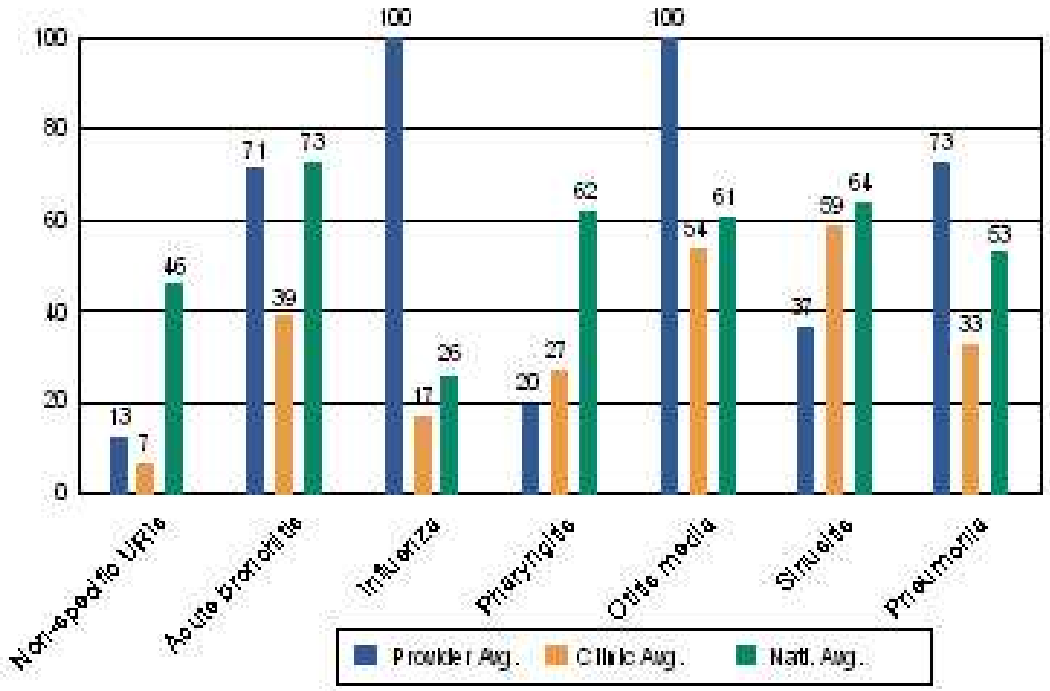
% Broad spectrum prescribed in ARI visits with antibiotics

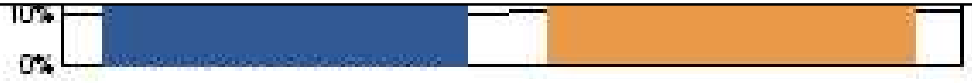
Narrow spectrum:
Broad spectrum:

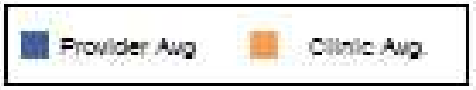
Note: For acute bronchitis and non-specific URIs the national guideline is zero.

provider n=	24	14	2	39	7	19	11

% ARI visits with antibiotics by diagnosis







ARI QD Feedback

- *Users find the ARI QD report with billing data (diagnosis and level of service codes) very useful since this type of reporting that combines LMR data with billing data is new.*

- *Users find the tool as a good test of system data check since reports are better with better coded value documentation, as opposed to free-text and outside data points.*

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CAD Quality Dashboard Features

- Focus on several measures of CAD quality
- Graphical and tabular views
- Actionable
  - Individual patient: “drill down” to Smart Form
  - Lists of patients: link to EMR Patient List function for batch letters and documentation

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CAD Quality Dashboard

Red, yellow, and green indicators show adherence with targets

Targets are 90th percentile for HEDIS or for Partners providers

Zero defect care:

- Aspirin
- Beta-blockers
- Blood pressure
- Lipids

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CAD Quality Dashboard

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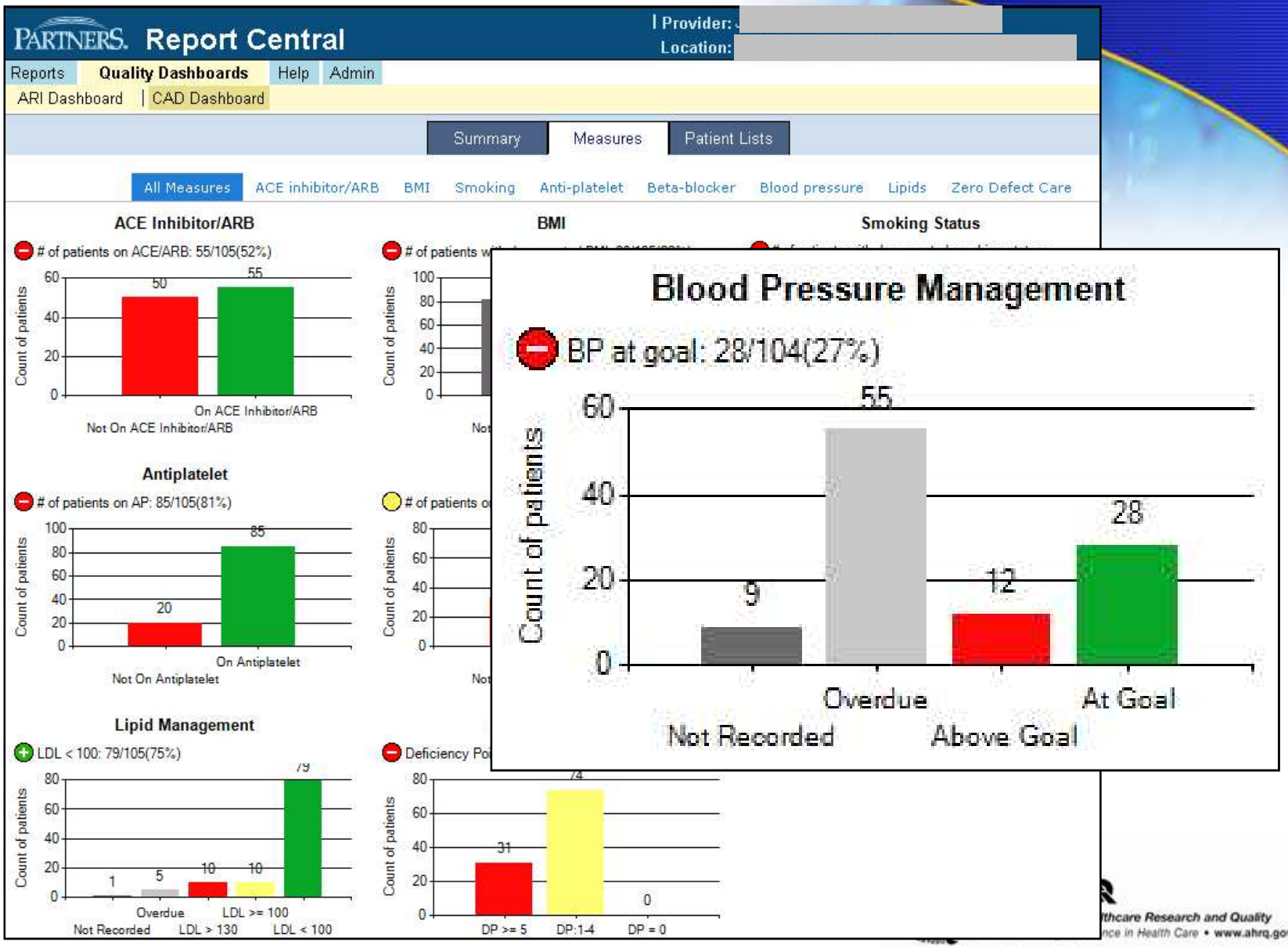

CAD Quality Dashboard

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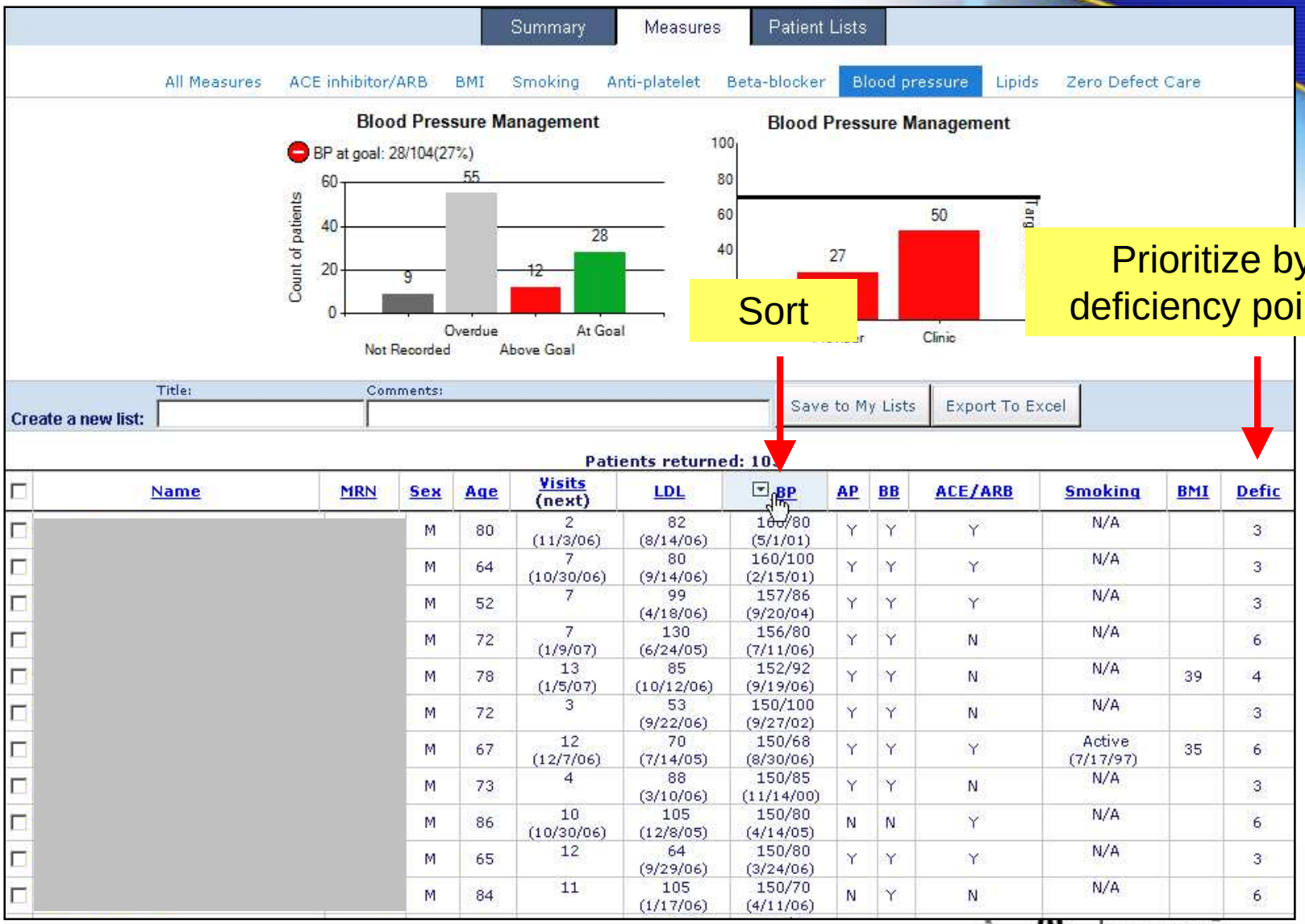

Name	MRN	Sex	Age	Visits (next)	LDL	BP	AP	BB	ACE/ARB	Smoking	BMI	Defic
		M	80	2 (11/3/06)	82 (8/14/06)	160/80 (5/1/01)	Y	Y	Y	N/A		3
		M	64	7 (10/30/06)	80 (9/14/06)	160/100 (2/15/01)	Y	Y	Y	N/A		3
		M	52	7	99 (4/18/06)	157/86 (9/20/04)	Y	Y	Y	N/A		3
		M	72	7 (1/9/07)	130 (6/24/05)	156/80 (7/11/06)	Y	Y	N	N/A		6
		M	78	13 (1/5/07)	85 (10/12/06)	152/92 (9/19/06)	Y	Y	N	N/A	39	4
		M	72	3	53 (9/22/06)	150/100 (9/27/02)	Y	Y	N	N/A		3
		M	67	12 (12/7/06)	70 (7/14/05)	150/68 (8/30/06)	Y	Y	Y	Active (7/17/97)	35	6
		M	73	4	88 (3/10/06)	150/85 (11/14/00)	Y	Y	N	N/A		3
		M	86	10 (10/30/06)	105 (12/8/05)	150/80 (4/14/05)	N	N	Y	N/A		6
		M	65	12	64 (9/29/06)	150/80 (3/24/06)	Y	Y	Y	N/A		3
		M	84	11	105 (1/17/06)	150/70 (4/11/06)	N	Y	N	N/A		6

CAD Quality Dashboard

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Filter. For example, patients with blood pressure not at goal who have had 0 or 1 visit in the past year

Filters ... Show/Hide Filters: -

Lipids	Blood Pressure	Smoking Status	BMI	Anti-platelet	Beta-blocker
☐ At goal: <100	☐ At goal	☐ Meet goal	☐ At goal	☐ Meets goal	☐ Meets goal
☐ LDL >= 100	☑ Above goal	☐ Do not meet goal	☐ Above goal	☐ Not on (indicated/ not contraindicated)	☐ Not on (indicated/ not contraindicated)
☐ LDL >130	☑ Markedly above goal	☐ Recently quit	☐ Markedly above goal	☐ Contraindicated	☐ Contraindicated
☐ Overdue	☑ Out of date	☐ Out of date	☐ Out of date	☐ Not indicated	☐ Not indicated
☐ Not recorded	☑ Not recorded	☐ Not recorded	☐ Not recorded		

ACE-I/ARB	Future Visits	Visits in last year	Sex	Age	Zero Defect Care
☐ Meets goal	☐ No scheduled visit	☑ 0	☐ Female	☐ <18	☐ 0
☐ Not on (indicated/ not contraindicated)	☐ Within 1 week	☑ 1	☐ Male	☐ 18-40	☐ 1 ☐ 8
☐ Contraindicated	☐ Within 2 weeks	☐ 2	☐ Unknown	☐ 41-50	☐ 2 ☐ 9
☐ Not indicated	☐ Within 1 month	☐ 3 or more		☐ 51-60	☐ 3 ☐ 10
	☐ Within 3 months			☐ 61-70	☐ 4 ☐ 11
				☐ 71-85	☐ 5 ☐ 12
				☐ >85	☐ 6 ☐ 13
					☐ 7 ☐ 14

Clicking on name opens patient's Smart Form

Create a new list: | Save to My Lists | Export To Excel

Patients returned: 3

Name	MRN	Sex	Age	Visits (next)	LDL	BP	AP	BB	ACE/ARB	Smoking	BMI	Defic
[redacted]		M	49	1 (1/19/07)	88 (8/12/05)	145/78 (8/2/06)	N	N	N	N/A		6
		M	34	1	67 (12/21/04)	135/80 (8/27/01)	N	N	N	N/A		6
		M	58	1	69 (3/7/06)		Y	Y	N	Active (3/7/06)		4

CAD QD Feedback and Pilot Results

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In general, pilot user feedback has been positive. All the physicians have commended the disease-specific snapshot reporting tool that allows them to navigate between measures and drill down to a specific patient view easily.

- Users like the ability to define the query and create their own list of CAD patients starting from the base set that the system generates.
- Users like the ability to see the snapshot view graphically as well as in summary format.
- Users find the tool as a good test of system data check since reports are better with better coded value documentation, as opposed to free-text and outside data points.

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Quality Dashboards ↔ Smart Forms

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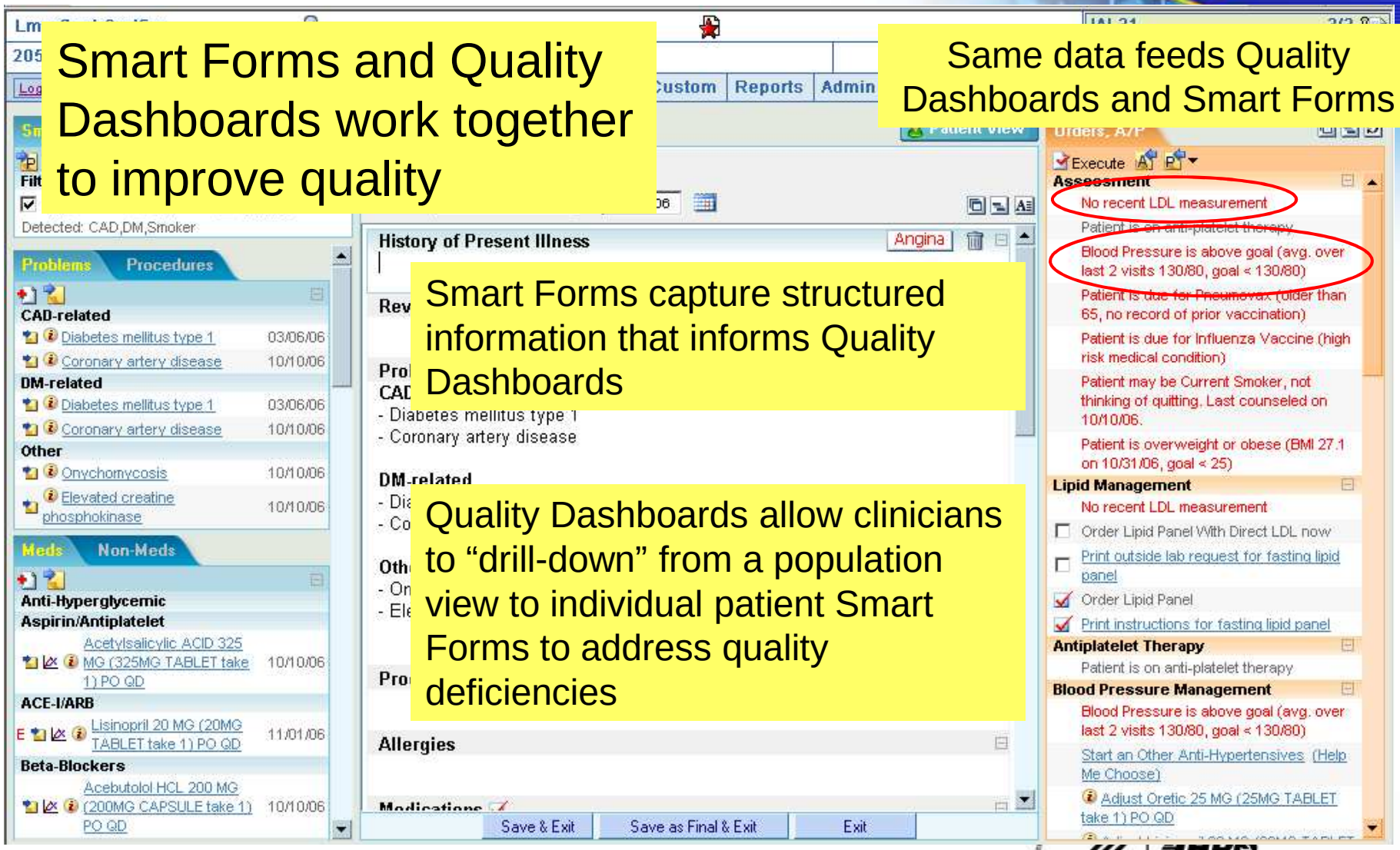
Smart Forms and Quality Dashboards work together to improve quality

Same data feeds Quality Dashboards and Smart Forms



Smart Forms capture structured information that informs Quality Dashboards

Quality Dashboards allow clinicians to “drill-down” from a population view to individual patient Smart Forms to address quality deficiencies

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Evaluation

1. Usability testing
2. Pilot testing
3. Randomized controlled trials

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Development and Usability Testing

- Focus Groups
- Prototype development
- Iterative refinement
- Pilot Testing
  - Real time on-line feedback
  - Surveys before and after use
  - Usability Lab
  - Interviews by outside consulting firm

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ARI Smart Form – Pilot Results

	Smart Form Pilot		Previous Season	
	Visits, N	Antibiotic, N (%)	Visits, N	Antibiotic, N (%)
Antibiotic Appropriate Diagnosis	6	6 (100)	367	154 (42)
Non-Antibiotic Appropriate Diagnosis	20	3 (15)	1027	269 (26)

CAD/DM Smart Form – Pilot Results

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	Smart Form Pilot		Previous 6 weeks	
	Deficiency	Deficiency Addressed	Deficiency	Deficiency Addressed
Beta-Blocker Rx or CI	3/134 (2.2)	2/3 (66.7)*	24/924 (2.6)	1/24 (4.2)
Up to Date Blood Pressure	14/134 (10.5)	13/14 (92.9)*	133/924 (14.4)	43/133 (32.3)
Smoking Status documented	45/134 (33.6)	11/45 (24.4)*	339/924 (36.7)	21/339 (6.2)
Up to Date Height and Weight	95/134 (70.9)	10/95 (10.5)*	634/924 (69.6)	34/643 (5.3)

*$p < 0.05$

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Randomized Controlled Trials

- ARI Smart Form
  - Completed, analysis in progress
- CAD Diabetes Smart Form
  - In progress
- ARI Quality Dashboard
  - Nearing completion
- CAD Quality Dashboard
  - To begin after CAD DM Smart Form RCT completed

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Challenges

- Dependence on external software development
- Physician vs. clinic level randomization
- Reconciling research agendas of several simultaneous IT projects
- Creating knowledge management infrastructure

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Dependence on Software Development

- Smart Forms dependent on outpatient order entry and on LMR services
- Delayed product development and RCT start
- **Solutions**
  - Get development support at highest levels
  - Make needs clear
  - Prioritize and pick battles
  - Minimize dependence if possible
- **Lesson Learned:** Anticipate and manage

Physician vs. Clinic Level Randomization

- Clinic level
  - Pros: training and support easier, minimizes contamination
  - Cons: clustering by clinic, potential for uncontrolled confounding
- Physician level
  - Pros: no clustering, more effective randomization
  - Cons: training and support more difficult, potential for contamination among physicians
- **Lessons Learned**: be flexible and willing to re-evaluate as situations change

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Reconciling Research Agendas of Multiple IT Projects

- Questions to Ask: How similar are…
  - The interventions?
  - Target patient populations?
  - External requirements?
  - Logistics of implementation
  - Outcomes to be measured?

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Reconciling Research Agendas of Multiple IT Projects

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- Conversion to multiple arm study
  - Good when overlapping interventions and outcomes
  - Sacrifices statistical power
- Simultaneous studies in different populations
  - Good when populations can be separated
- Simultaneous studies in same population (e.g., 2x2 factorial design)
  - Good when little chance of synergy between interventions
- Head to head comparison
  - Good when no overlap, each can serve as control for the other
- **Lessons learned**: need for broad dialogue among stakeholders

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Creating Knowledge Management Infrastructure

- Cons
  - Large up-front investment
  - Potential delays in design
  - Bureaucracy
- Pros
  - Mechanism for connecting subject matter experts with programmers
  - Much more scalable as decision support expands
- **Solutions**:
  - Knowledge management group
  - I-log software

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Creating Knowledge Management Infrastructure

- **Lessons learned**
  - Flow diagrams for subject matter experts
  - Other formats for analysts & programmers
  - Finalize logic among small group
  - Public e-space to promote dialogue
  - Detailed indexing of all logic elements
    - Re-use
    - Prevent redundancy

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Lessons Learned: General

- Pilot data encouraging to date
- Potential synergy between Smart Forms and Quality Dashboards
- New paradigms for decision support

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Lessons Learned: Smart Forms

- Major barriers to use relate to workflow and human factors issues
- Coded data entry
  - What is the correct amount?
  - May depend on complexity of condition, degree to which data influences decision support, billing requirements, style of individual practitioner

Lessons Learned: Smart Forms

- ARI
  - Greater impact on promoting appropriate antibiotic use than discouraging misappropriate use?
  - Better coding of diagnoses vs. more appropriate care
  - So far, limited to stand-alone ARI visits
    - Will be addressed in future versions

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Lessons Learned:
Smart Forms

- CAD/DM
  - Impact greater on documentation than on clinical inertia?
  - Biggest barrier is change to current workflow
  - Future versions will incorporate health maintenance, other acute and chronic conditions, other features to make it more appealing to use
  - Can we reach the tipping point?

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Lessons Learned: Quality Dashboards

- Biggest barriers to use are related to the health care system
  - What are the drivers (carrots and sticks) to QD use?
    - Pay for performance
    - Reimbursement for case management
  - For chronic diseases, QD may be more effective as a case management tool

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Lessons Learned: Quality Dashboards

- Other major barrier is related to quality of the data
  - Absolute need to tie patients to providers, edit panels, deal with missing data
  - Won't change behavior unless the data are believable
- Big societal trends will drive quality measurement
  - Can providers be proactive? (EHR data better than billing data)

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Lessons Learned: HIT Research

- Challenges include IT implementation among providers, external dependencies, randomization issues, competing interventions, and knowledge management
- Concurrent RCTs superior to before-after trials if can be done
- Anticipate and manage problems, but be prepared to be flexible if conditions change

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Conclusions

- Smart Forms and Quality Dashboards offer new paradigms to manage acute and chronic medical conditions using EHR technology
- Both have potential to improve care, demonstrate EHR value to providers, and drive EHR use
- Much work remains to be done

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Managing Smart Forms Project

Highlights from the past 3 years

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HIT project
from the management perspective

- Challenges
  - Tough goal
  - Smart, motivated people
  - New challenges every day
- Rewards
  - Tough goal
  - Smart, motivated people
  - New challenges every day

vase or 2 faces?

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Challenges

Every stage has its own unique challenges

- Development
- Study design
- Implementation
- Data analysis
- Manuscript preparation

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Development

- Software created was very complex
  - Different forms (ARI and CAD)
  - LMR dev team has its own agenda
  - Involvement of other Partners' departments (KM)
  - Incorporating usability expertise and feedback
- Design challenges
- Consideration of needs of a diverse group of clinicians
- Financial struggle to support developers for research purpose (CAD QD)
- Any dev delays caused delays for whole project

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Study design and data collection

- Multiple research studies ongoing at Partners created a need for very careful study design and complicated randomization schemas
- Lack and disparate information (PCP lists, residents lists)
- On-line surveys yielded typical response rate

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Training and implementation

- Selling the idea to practices
  - Practice leaders
  - End users: physicians and residents
- Implementation
  - Accommodate practice readiness & scheduling
- Training
  - Comply to needs of different users
  - Provide personal training if needed
- Support after implementation
- Additional resources for implementation process would help to increase usage

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Analysis

- Time consuming and tedious
- Extremely complex programming
- Cleaning data requires on-going involvement of co-investigators
- Data retrieval process
  - Unique for BWH and MGH patient data
  - No central place to get data

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Team issues

- Strong personalities with different ideas
- Not everyone is born to be a perfect team player
- Loss of key people during the study

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Nature of doing HIT research at Partners

- Co-investigators and PI work on numerous projects
- Work between physicians and developers
- Cooperation with different groups (CITL, CIRD, QDM) – necessary, hard, and beneficial
- Partners culture around research work
  - Why research is needed
  - What research needs are
  - Issues with access to research DB, data, etc.
- Distance between
  - Research team and co-investigators
  - Research team and clinics
  - Co-investigators and developers

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How did we succeed?

- Team excellence
  - Right team composition
  - Experience in different areas
  - Previous research experience
  - Goal oriented
  - Ability to manage team challenges
- High involvement of co-investigators at all stages of the grant
- Previous experience with conducting similar research at Partners
- Early determination of research questions and data of interest (Analysis Plan)

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Strong management & project management

- Decision-making hierarchy (buck stopped with the PI)
- High involvement of co-investigators
- Communication / negotiation skills
- Careful proactive planning for every project stage
- Weekly meeting for the whole team
- Agenda and “To-Do” items on weekly basis
- Documentation of all steps (including research DBs development)
- Learning during Pilot stages to have smooth RCTs

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Rewards

- Accomplishing difficult tasks
- Positive feedback from physicians
- Results dissemination at national conferences and through manuscripts
- Getting feedback from a wide range of researchers
- Making a difference in patient care?

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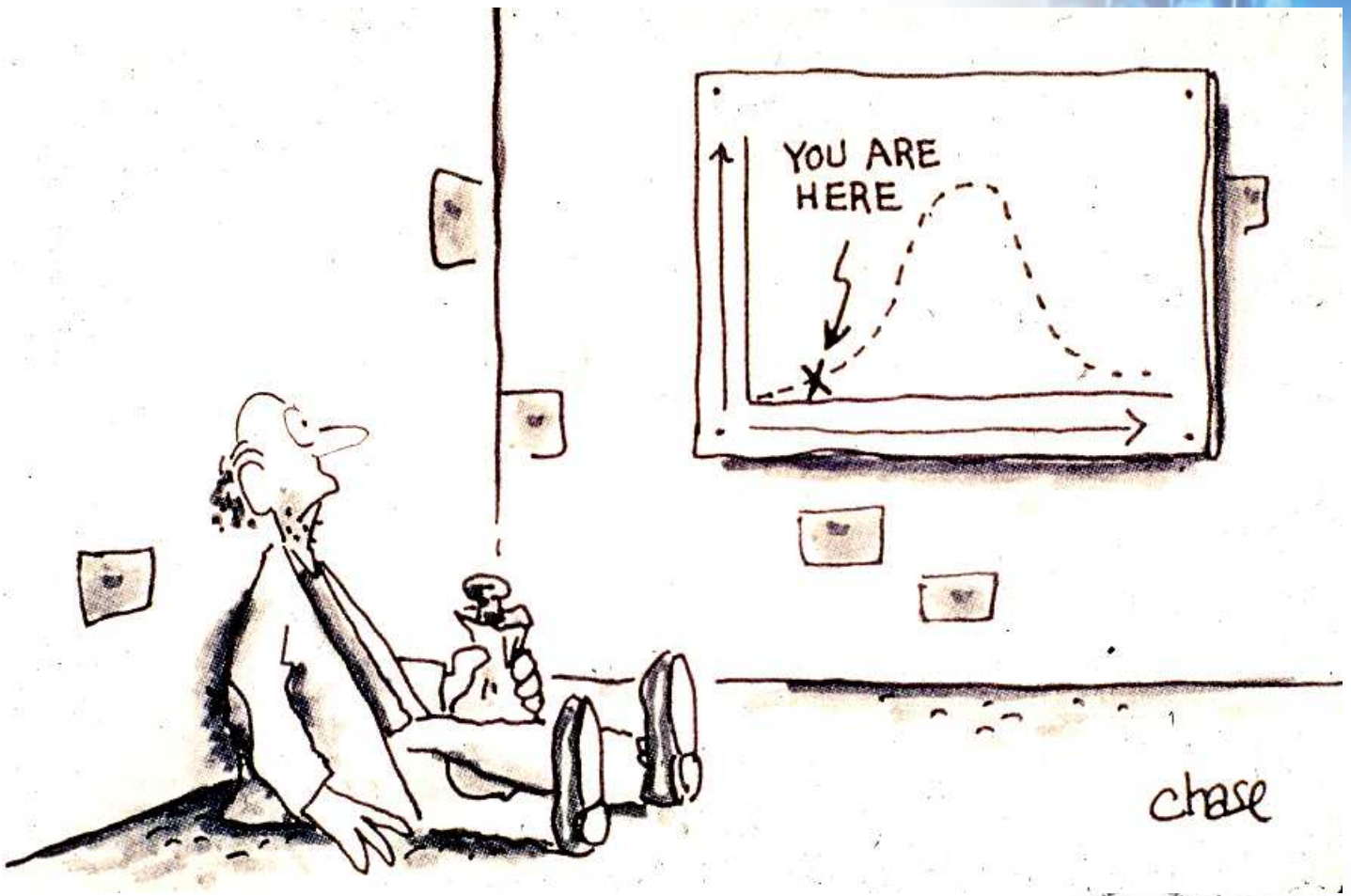
Where Are We?



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Discussion, Q&A

Thank you!

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C!TL

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